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Special Issue 2025 - Climate Change, Migration, and Conflict: Lessons in Education

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Editorial Introduction
Climate Change, Migration, and Conflict: Lessons in Education

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The *Special Issue on Climate Change, Migration, and Conflict: Lessons in Education* commemorates the 10th anniversary of the Paris Agreement. In 2015, 196 Parties to the United Nations Climate Change Conference adopted a treaty to hold the increase in global average temperature below 2°C above pre-industrial levels, and limit the rise to 1.5°C. Given the relevance of this international agreement and the vital role education plays in fostering knowledge about the effects of climate change, we invited potential contributors to reflect on what has been undertaken in education and what could be done differently to protect Mother Earth. We raised manifold questions, including: What is the relationship between education and climate change? What are the direct and indirect links between internal or international conflicts with environmental damage, and how do these intersections relate to education? To what extent do migration policies and projects in education account for the impacts of climate change on the lives of internally displaced persons, refugees, and migrants? What perspectives do Indigenous epistemologies bring to education, considering climate change, migration, and conflict at policy, curriculum, and pedagogy levels? How is environmental justice interconnected with educational justice? Upon a thorough review, the editorial board curated 12 publications from authors in Comparative and International Education (CIE) and other fields that examine these areas of inquiry in different contexts and from a wide range of theoretical perspectives.

This Special Issue was an opportunity to explore intersections between conflict and climate change with an emphasis on education, as well as a chance to dive deeper into educational research about how climate change can interrelate with migration. The manuscripts discuss lessons in education concerning climate change, migration, and conflict at various scales (personal, local, regional, and global). While some explore the historical progress in international agreements on climate change that are relevant to education policy and practice, other authors analyze primary data about the experiences of teachers vis-à-vis climate change education. We organized the Special Issue into 3 sections: articles, essays, and book reviews.

The first part includes 6 research articles applying quantitative and qualitative data to address questions on the intersection between education and climate change. Some make direct references to climate displacement and conflict. **Oren Pizmony-Levy and Sarah Alice Wagner** recognize the urgency to address the impacts of anthropogenic climate change. They argue that climate change education promotes climate action and

that teachers are central to the development and implementation of climate change education. Through a partnership between Teachers College, Columbia University, and the New York City Public Schools, the research studies teachers' beliefs, attitudes, and practices on climate change and education in New York City, offering policy recommendations based on first-hand data. Key findings include high concern and negative emotions about climate change. Pizmony-Levy and Wagner (2025) identify that the school time devoted to climate change education has increased, but teachers continue to perceive the topic as one relevant to the STEM curriculum.

Muhammad Arif, Aneta Ismail, and Yao Jia Li examine teacher resilience, coping strategies, and education continuity across primary schools after the 2022 Balochistan floods in Pakistan. Analyzing data from semi-structured interviews and focus groups (n=15), Arif and colleagues (2025) discuss how teachers changed their teaching methodologies, managed their emotions, faced psychological barriers, and used community resources to overcome the impacts of the floods in their classrooms and beyond. The study is critical for post-disaster recovery in Pakistan, as it sheds light on the different challenges rural and urban educators confront, and the importance of fostering emotional regulation tools and social support networks for teachers.

Tien Pham focuses on the impacts of climate change and climate displacement on children's education. Considering a Human Rights-based Approach (HRBA) framework and work in Education in Emergencies, Pham (2025) combines literature and policy about the barriers climate-displaced students confront to access and remain in education. A section is devoted to gendered vulnerabilities, exploring literature on the effects of climate change and displacement on girls' education. **Lauren Madden** analyzes interviews and classroom observations with 50 teachers in New Jersey (NJ), as NJ was the first state in the United States (U.S.) to implement learning standards that support climate change education K-12 across all subject areas during the 2022-2023 academic year. Madden (2025) finds that the principal mode of professional learning about climate change among teachers was self-directed. Some attended specific workshops or webinars. Many educators did not receive formal training beyond the introduction of climate change standards. The study calls for comprehensive and official professional development incorporating best practices about how and what to teach about climate change in NJ K-12 classrooms.

Sarah Marie Kistner and Maha Shoaib exemplify how a collaborative autoethnography on the intersection of environmental crises, individual experiences, and education between two teachers in Pakistan and the U.S. can offer relevant insights on the intimate effects of disasters in the lives and work of teachers. Upon narrating their experiences with two distinct disasters, Kistner and Shoaib (2025) advocate for climate-just education, considering trauma-informed pedagogies and climate-responsive curricula. They discuss how the Butterfly Hug Technique, Emotional Freedom Technique (EFT), and Yoga Nidra can support teachers and students to cultivate emotional resilience after

a disaster. The last article in this section by **Tianshu Chen and Debojyoti Das** is a qualitative case study about the impact of the 1.5 MAX initiative on climate change education across secondary schools in Malawi, applying an Education for Sustainable Development framework and decolonial theory. Since Indigenous knowledges are disregarded in Malawi's curricula, Chen and Das (2025) call for the integration of Indigenous knowledges in local schools when educating students about climate change and environmental sustainability.

The second section includes 4 essays discussing topics ranging from decolonial educational ecologies in CIE, the Just Transition, to a critical analysis of the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Education for Sustainable Development 2030 Framework. **Benjamin D. Scherrer and tavis d. jules** explore methods to study the intersections between climate change and education. Scherrer and jules (2025) reconsider "educational approaches that do not rely on endless economic growth, extraction, and accumulation through dispossession" (p. 153). They question discourses about climate solutions, shedding light on the absence of Black and Indigenous knowledge systems and cosmologies in the United Nations Sustainable Development Goals. Applying a decolonial educational ecology framework, both scholars highlight the importance of "creating alternative pathways toward more sustainable, just futures" (Scherrer & jules, 2025, p. 153).

The second essay by **Catherine Wong** overviews the trajectory of international agreements on climate change, climate displacement, and conflict to discuss limited climate financing in countries confronting environmental challenges the most. Wong's analysis shows that without investments in capacity development and education, the implementation of climate agreements will not be sustainable or effective. **Radhika Iyengar, Syed Nitas Iftekhar, Matthew Witenstein, and Karen Chand** write about how the concept of ecopedagogy and grassroots work relate to climate justice and are essential for a Just Transition (JT). JT refers to approaches to guarantee integration of all members of society, and their livelihoods in sustainable development. The last essay in the Special Issue by **Srinitya Duvvuri** proposes a critical analysis of the UNESCO Education for Sustainable Development 2030 Framework (ESD 2030). ESD 2030 is a roadmap for countries to incorporate education for sustainable development across schools, universities, and other professional learning sectors.

The third part of the Special Issue comprises two book reviews; one by **Debojyoti Das**, who explores anthropologist Peter Sutoris' book on *Educating for the Anthropocene: Schooling and activism in the face of slow violence* (2022). **Jun Kajee** presents a book review about *The Ages of globalization: Geography, technology, and institutions* (2020) by economist Jeffrey D. Sachs. The reviewers emphasize how these books can aid educators and students in understanding the links between globalization and climate change.

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I take the opportunity in this editorial introduction to highlight CICE's achievements during the 2024-2025 academic year. In terms of publications, we successfully published two Special Issues, one dedicated to Human Rights in Comparative and International Education. Regarding our digital presence, a key development was the launch of our new website available in Spanish, Portuguese, and English. CICE completed its application for the Directory of Open Access Journals (DOAJ), and we transferred CICE: The Podcast to a Columbia University Library Podcast. Our podcast is featured on Spotify and Apple, and our social media engagement was substantially enhanced across Facebook, Instagram, and X. None of these accomplishments would have been possible without the voluntary contributions of 21 graduate students from Teachers College, Columbia University.

I hope that CICE will continue to publish work that challenges and advances, in exciting ways, difficult and important conversations in CIE. CICE is a vital platform for rigorous critical inquiry and collaborative exchanges for scholars and practitioners worldwide to reflect on the past, present, and future of education. Serving as the editor-in-chief this year has been an honor, and I extend my best wishes to the incoming leadership team.

Acknowledgments
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Between Urgency and Uncertainty: The Challenge of Being a Human and an Educator in the Age of Climate Change

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The window in which humans should act to avoid the extreme impacts of anthropogenic climate change is closing. Addressing this crisis requires collective action and political will. Climate change education (CCE) is a global movement and a long-term strategy to empower people to engage in climate action. Educators are at the heart of this movement, tasked with appropriating CCE frameworks to the reality of their context and classroom. This study uses survey data from a research-practice partnership between Teachers College, Columbia University, and New York City Public Schools to explore educators' beliefs, attitudes, and practices on climate change and education. Our findings paint a complex picture. Educators show high levels of concern and negative emotions about climate change, confusion, and underestimation of climate change causes and impacts. Educators support comprehensive CCE in schools and are aligned with international frameworks. While we find growing instructional time dedicated to climate change, the data point to sociological barriers (e.g., perception and labeling of climate change as relevant to the STEM curriculum). We discuss the implications of our findings and offer strategies to enhance CCE in New York City and beyond.

Keywords: Climate change, Sustainability, Climate Change Education, Teacher Beliefs and Attitudes, Instructional Practices, Research-Practice Partnerships, New York City.

Introduction

Scientific consensus views human activity as the primary driver of climate change, particularly through fossil fuel (coal, oil, gas) combustion, land-use change, and unsustainable patterns of production and consumption (Intergovernmental Panel on Climate Change [IPCC], 2023). Adverse impacts from climate change are widespread and affect numerous natural and human systems, including education.[1] Comparative research has documented that exposure to high temperatures during the school year is associated with reduced learning rates across diverse national and subnational contexts, contributing to education disparities linked to climate conditions (Park et al., 2021). Concerns about climate change as a global threat have increased among young people since 2016 (Schultz et al., 2025; von Davier et al., 2024). Students carry these concerns

[1] For review of the multiple impacts of climate change on education, see Global Partnership for Education, 2024.

into the classroom, where teachers feel responsible for addressing them. Education and public awareness are seen as a climate solution (United Nations [UN], 1992).

Climate change education (CCE) is a global movement to expand high-quality teaching about climate change's causes and consequences to promote meaningful climate action (Reid, 2019; UN Educational, Scientific and Cultural Organization [UNESCO], 2024). Rapid emissions mitigation efforts can slow the process of climate change and reduce the likelihood of continued and intensified adverse impacts (UN Environment Program [UNEP], 2024b). Widespread and equitable implementation of adaptation measures would reduce harm, but the opportunity window to implement changes is short (UNEP, 2024a). Countries can execute these actions if their public is informed and motivated.

As part of broader education efforts such as Environmental Education and Education for Sustainable Development, CCE extends beyond transmitting information to empower individuals with attitudes, motivation, and skills to address climate challenges and engage in collective efforts. International frameworks like the UN Framework Convention on Climate Change (UNFCCC) and the Paris Agreement (2015) recognize the significance of this objective. Article 6 of the UNFCCC (1992) emphasizes education and training as tools to foster public participation toward addressing climate change and its effects. Article 12 of the Paris Agreement highlights the role of education, training, and public awareness to enhance and coordinate climate action globally.

The UNFCCC's Action for Climate Empowerment (ACE) framework encompasses work and strategies to this end and envisions successful implementation as creating "a population whose deep-seated appreciation of the climate challenge leads to greater national action and commitment" (UNFCCC, n.d.). According to the ACE framework, developing pedagogies, curricula, and educator training programs is critical to building broad support for climate action and reducing the ongoing harm and disruption of climate change. However, many education systems have adjusted slowly to climate change and the uptake of CCE practices (UNESCO, 2019). As the group charged with implementing CCE objectives on the ground, educators should be considered as key advocates for a climate-informed and empowered population.

We seek to understand educators' perspectives and commitment (or buy-in) to CCE. We draw on unique data collected through a research-practice partnership between the Center for Sustainable Futures at Teachers College, Columbia University (TC), and the Office of Energy and Sustainability at New York City Public Schools (NYCPS). Our data consists of surveys of school-based Sustainability Coordinators, a group that includes K-12 teachers, administrators, and other staff. We explore how these educators view climate change and CCE: how they understand the causes and impacts of climate change, the qualities and purpose of effective CCE, and how they translate these concepts into practice. Through understanding educators' beliefs, attitudes, and practices, we investigate the gap between international policy discourse about CCE and the local reality as reported by educators. We address four research questions:

RQ 1: What are educators' beliefs and attitudes toward climate change?
RQ 2: What are educators' beliefs and attitudes toward CCE and the role of education in addressing the climate crisis?
RQ 3: To what extent do educators teach about climate change and engage students with it? How do educators incorporate climate change into their teaching?
RQ 4: What factors influence educators' decisions to teach (or not) about climate change?

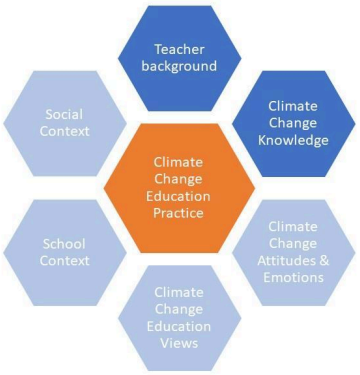
We aim to advance our understanding of local educational practices within the broader framework of global CCE initiatives in this article. By examining the intricate interplay between educators' personal beliefs, emotional responses, pedagogical beliefs, and strategies, we explore the complexity of teaching about climate change. Our analysis of survey data from New York City Public Schools (NYCPS) not only documents evolving trends over time but also exposes the gap between educators' beliefs and their classroom practices. With this analysis, we seek to bridge the divide between international frameworks and local implementation, offering insights that are vital for policymakers, curriculum developers, and educational leaders striving to integrate meaningful, context-sensitive CCE.

Background

We explore scholarship on teachers and climate change. Chart 1 illustrates the literature and highlights gaps. Growing research has focused on teachers, especially science teachers' knowledge and attitudes about climate change (orange and dark blue shapes). Studies have explored teachers' understanding of climate science, beliefs about its causes and consequences, and how these factors influence instructional practices. Little attention has been paid to the emotional dimensions of climate change and teachers' attitudes toward CCE as a pedagogical endeavor (light blue shapes). Due to the increasing urgency of climate action and the complex social and psychological challenges linked to CCE, a more holistic approach is needed, considering what teachers know, believe, and how they feel about engaging students with this critical issue.

Chart 1

Conceptual summary of literature review



Teachers' Climate Change Knowledge and Attitudes

When engaging in action- and solutions-oriented CCE, educators should emphasize the scientific consensus that the Earth's climate is changing due to human activity (IPCC, 2023). However, research shows that many teachers hold misconceptions about climate change, prioritizing natural, rather than anthropogenic causes of climate change in their lessons (Branch et al., 2016; Plutzer et al., 2016; Plutzer et al., 2024). Some teachers who personally accept anthropogenic climate change still choose to downplay the scientific consensus in their classrooms (Nation & Feldman, 2021). Teachers report gaps in understanding local impacts, the evidence behind scientific consensus, and climate solutions (Sullivan et al., 2014).

Pre-service training and professional development can equip teachers with accurate climate science and increase their confidence in engaging in CCE (Axelrod et al., 2020; Teed & Franco, 2013). Teachers who feel knowledgeable about climate change are more likely to teach climate change (Seroussi et al., 2019), emphasize anthropogenic causes in their lessons (Berkman & Plutzer, 2015; Branch et al., 2016; Plutzer et al., 2016), and perceive fewer barriers to teaching the topic (Ennes et al., 2021). These professional development opportunities are in demand among teachers (Branch et al., 2016; Sullivan et al., 2014). Despite the benefits, teachers often encounter time constraints when considering participation in professional development, a challenge that reflects broader patterns in professional development research (Ennes et al., 2021; da Rocha et al., 2020). Some teachers with limited expertise still engage with climate change in their classrooms (McNeal et al., 2016), while others with strong knowledge may hesitate (Seroussi et al., 2019), suggesting that knowledge alone does not determine climate change instruction.

Climate Change Education Practice

Despite numerous barriers to integrating CCE, educators continue to engage students on this topic. Earth science teachers are the most likely to incorporate climate change topics into their instruction (Wise, 2010), but non-science teachers enhance climate literacy by incorporating interdisciplinary strategies in social studies, language arts (Siegner & Stapert, 2020), and artistic expression (Baker et al., 2013). Beyond content knowledge, CCE fosters essential skills such as research, critical thinking, civic engagement, and decision-making (Ardoin et al., 2017). The literature identifies several best practices, including embedding constructive hope into the curriculum (Ojala, 2015), facilitating deliberative discussions, engaging with scientists, addressing misconceptions, and implementing school or community projects (Monroe, 2017). Effective strategies emphasize collective action (Jorgenson et al., 2019), interdisciplinary connections (Rousell & Cutter-Mackenzie-Knowles, 2019), and real-world applications through project- and place-based learning. Holistic, experiential learning opportunities have been particularly successful in deepening students' understanding of climate issues (Stern et al., 2013), with student-centered approaches yielding the most impactful outcomes (Karpudewan et al., 2014; Stern et al., 2013).

New Directions for Research on Teachers, Climate Change, and Education

Our review of the literature, along with research on public opinion and climate change (e.g., Egan & Mullin, 2017; Leiserowitz, 2007; Shwom et al., 2015), reveals critical gaps that this study seeks to address. Existing research focuses primarily on science teachers, overlooking the role of educators in other subject areas in facilitating CCE, as well as other key adults in schools, such as administrators, paraprofessionals, and support staff. Researchers must expand the scope of inquiry to include a broader range of educators to understand how CCE can be integrated across the school ecosystem.

While research has explored the cognitive and pedagogical dimensions of CCE, it has largely overlooked the role of teachers' emotions in shaping their CCE practice. Emotions and affect certainly influence judgments and behavior related to climate change outside of education (Brosch, 2021). When applied to educators, this influence may manifest in multiple ways: teachers who feel a strong personal connection to climate change may be more motivated to integrate it into their teaching, while those experiencing climate anxiety, frustration, or a sense of helplessness may avoid the topic altogether. Attending to teachers' emotions is important for their well-being and serves as a model to incorporate discussions of emotions and mental health into their teaching of climate change. By recognizing and addressing the affective dimensions of climate education, we can better equip educators with strategies to navigate their own emotions while fostering students' emotional resilience and engagement with climate issues.

Third, existing research lacks a comprehensive exploration of teachers' views on CCE as a global education movement. There is limited understanding of what educators believe should be taught (e.g., causes, consequences, and key skills or competencies), what overarching frameworks should guide CCE (e.g., green career readiness, empowerment, or systems thinking), and what resources and support teachers need to effectively implement CCE in their classrooms.

This study aims to address these limitations by broadening the scope of inquiry beyond science educators, examining the emotional dimensions of CCE, and investigating how teachers conceptualize climate education within a global framework. By filling these gaps, our research will provide valuable insights for policymakers, school leaders, and educators seeking to advance CCE in meaningful and sustainable ways.

Study Setting: New York City (NYC)

We focus on the unique context of NYC for three key reasons. First, NYC already experiences the impacts of climate change, primarily through extreme heat, sea level rise, tidal flooding, extreme rainfall, and coastal storm surges, including Superstorm Sandy in 2012, and low air quality due to fires in Canada in 2023 (Bilefsky, 2023; New York State, n.d). These climate-related events might increase teachers' awareness of and motivation to engage with climate change.

Diversity and deep-rooted inequalities characterize NYC and the NYCPS system. NYCPS serves one of the most racially, ethnically, and linguistically diverse student populations in the United States (U.S.), yet economic disparities shape educational experiences. In the 2023/24 school year, three out of four NYCPS students were classified as economically disadvantaged, with more than a 30-percentage-point gap in economic need across boroughs (NYCPS, n.d.). These inequalities intersect with climate injustices, as predominantly low-income and minority communities are disproportionately exposed to coastal flooding, high heat vulnerability, and environmental injustices, while also facing greater air and water pollution and exposure to industrial sites (NYC Mayor's Office, 2024). The compounded effects of socioeconomic and environmental injustices make NYC a critical case for examining how CCE can address the immediate challenges of climate-related disruptions and the broader structural inequalities that shape students' learning environments.

NYC is widely regarded as a leader in sustainability and climate action. In 2023, the Mayor's Office released *PlaNYC: Getting Sustainability Done*, outlining initiatives for decarbonization, pollution reduction, and a circular economy while also launching new climate education and training programs for public schools. Beyond city-level commitments to CCE, NYC has enacted various policy instruments to promote whole-school sustainability efforts, such as the 2009 mandate requiring every public school to appoint a Sustainability Coordinator (Pizmony-Levy et al., 2021; Verschueren, 2021). While this supportive policy environment creates opportunities for CCE, systemic barriers remain. NYCPS prioritizes student achievement, and its reliance on standardized testing may have a chilling effect on teachers and schools interested in integrating CCE (Menken & Solorza, 2014; Pizmony-Levy & Gan, 2021).

Research suggests that teachers' sociopolitical environments shape their approaches to CCE: when climate change is perceived as controversial, teachers cite this as a barrier to classroom integration (Sullivan et al., 2014). Even educators who strongly affirm anthropogenic climate change may hesitate to engage in CCE due to fears of political backlash or resistance from stakeholders (Nation & Feldman, 2021). The political party of the state in which a teacher works is a stronger predictor of CCE implementation than their individual political beliefs (Khalidi & Ramsey, 2021). NYC presents a unique case where political resistance to CCE is relatively low compared to other parts of the U.S., making it an important setting for examining barriers beyond political hostility, such as curricular constraints, standardized testing pressures, and institutional capacity. Understanding these challenges in a supportive policy climate can provide insights into how to sustain and scale CCE efforts in more politically contested environments.

Data and Methods

Data for this study come from the New York City Partnership for Sustainability Education (NPSE), a research-practice partnership between the Office of Energy and

Sustainability at NYCPS and the Center for Sustainable Futures at TC. The NPSE collaboratively designs studies and collects data through surveys, interviews, focus groups, observations, and document analysis to understand and enhance the role of schools in advancing NYC's sustainability goals. The TC team manages a longitudinal dataset on Sustainability Education in schools, analyzes the data, and supports NYCPS in interpreting findings to inform policies and programs (for additional information about the partnership, see: Pizmony-Levy et al., 2021).

Since the 2019/20 school year, NYCPS has focused on climate change, responding to growing calls for climate action and education. This shift aligns with global initiatives such as the Paris Agreement (COP 21 in 2015) and its Action for Climate Empowerment (ACE) Framework, as well as the momentum generated by the global youth climate movement (e.g., Fridays for Future and the School Strike for Climate).[2] To support this focus, the partnership introduced questions about climate change into its annual survey program (details below), conducted interviews and focus groups with educators, and developed various professional learning opportunities to enhance CCE.

We analyzed data collected between 2020 and 2024 through two types of surveys administered to all Sustainability Coordinators: (a) The Sustainability & Climate Action Plan (SCAP), conducted in the fall (October–November), and (b) the End of Year Sustainability Survey (EYSS), conducted in the spring (May–June).[3] Both instruments are self-administered web-based questionnaires; they cover five key domains: (a) Sustainability Education (including CCE), (b) Communication and Outreach, (c) Health, Wellness, and Green Space, (d) Waste and Recycling, (e) Energy Conservation and Efficiency. The SCAP focuses on assessing needs and intentions for action within these domains, while the EYSS evaluates activities completed throughout the year. Additionally, the surveys include a comprehensive set of background variables (e.g., sex, race/ethnicity, role in school, grade level, subject area, etc.) and attitudes on different issues, providing rich contextual data for analysis. Table 1 shows the availability of climate change and CCE-related questions by survey type and year.

[2] In March 2020, the New York City Council published a report titled *Securing Our Future*, outlining strategies the city could adopt to combat climate change. The report focuses on four key areas: Resiliency, Energy and Emissions, a Sustainable and Circular Economy, and a Green Jobs Pipeline. Among its recommendations, the report advocates for decarbonizing the student bus network, expanding Career and Technical Education (CTE) programs for green jobs, and integrating CCE into all schools. It states: "As keepers of this future, students should be provided with a complete and accurate picture of how human activity affects the Earth and how the world can mobilize to address the impacts of climate change. In a landscape where attitudes toward science have become more hostile, with fear and doubt being used to sow confusion, it is vital for students to be provided with evidence-based education on climate change."

[3] Each year, approximately one-quarter of sustainability coordinators are new to their role. Possibly, some coordinators have participated in the survey multiple times across different years.

Table 1

Availability of Questions by Theme, Survey Type, and Year

Variable/Theme	Fall 2019	Spring 2020	Fall 2020	Spring 2021	Fall 2021	Spring 2022	Fall 2022	Spring 2023	Fall 2023	Spring 2024
Items about CC										
Cause of CC: Human activity vs. Earth's natural cycle			+							
Feeling informed			+			+				+
CC Concern		+	+	+	+	+	+	+	+	+
CC emotions						+				
CC is an important problem in NYC.	+									
Impact of CC				+						
Items about CCE										
Schools should teach CC.			+							
Attitudes about CCE			+							
What should be included in CCE?			+	+						
CCE resources (needs assessment)			+		+					
CC as a topic of interest	+			+		+				
Perception of colleagues' engagement with CCE						+				
Attitudes towards the Climate Action Days initiative								+		+
Definition of "climate action"							+		+	
Items about CCE practice										
Do you teach about CC?			+	+		+		+		+
If yes, frequency of teaching				+		+		+		+
Examples of teaching				+		+		+		
If not, why not?			+					+		
Frequency of talking CC				+		+		+		+
Examples of talking CC				+		+		+		

Items in the sustainability education domain							+	+	+	+
Items about students and CC										
Students' engagement in local Climate Week activities	+				+		+		+	
Perception of students' engagement with CC						+				
Awareness of the global youth climate movement					+					

Note. CC = climate change; CCE = climate change education; shaded background (+) indicates items analyzed in this study.

The NPSE developed climate change-related survey questions based on scholarly research, media coverage, and consultations with key stakeholders. For example, we used close-ended questions from preexisting surveys (e.g., NPR/IPOS, 2019; Yale Program on Climate Communication, 2021). We also borrowed ideas for questions from the OECD's Teaching and Learning International Survey (TALIS) and the IEA's Trends in International Mathematics and Science Study (TIMSS).

Table 2 presents the sample size and descriptive statistics for the socio-demographic composition of the sample, disaggregated by survey type (SCAP and EYSS) and year. The sample includes school-based sustainability coordinators. The sample size ranges from 1,264 to 1,566 respondents and, on average, represents 77% of all NYC public schools. In terms of grade levels, 44% of the sample is drawn from K–5 schools, 11% from K–8 schools, 15.3% from middle schools (grades 6–8), and 29.7% from high schools (grades 9–12). Nearly two-thirds of respondents (65.5%) are women. About half of the sample (47.6%) identifies as white, with a similar representation of Black (17.6%) and Latinx (16.2%) educators. Almost half of the respondents (45.3%) are teachers, while the remainder are assistant principals (27.1%) or hold other school-based roles (27.6%). Among the teachers, approximately two-thirds (62.5%) teach science. One-third of the sustainability coordinators volunteered or self-selected for the role, while the rest were appointed by their principal. Most of the educators (58.4%) have worked at their current school for eight years or more; 32.8% have been at their school between three and seven years, and 8.9% for less than two years.

Table 2

Overview of Sample Characteristics by Survey Type and Year

Variable/Theme	Fall 2019	Spring 2020	Fall 2020	Spring 2021	Fall 2021	Spring 2022	Fall 2022	Spring 2023	Fall 2023	Spring 2024
Sample size	**1466**	**1320**	**1480**	**1332**	**1566**	**1447**	**1394**	**1310**	**1413**	**1264**
Gender (percent)										
Man	28.3	27.5	29.3	28.7	31.5	30.3	28.3	27.8	27.2	26.3
Woman	64.3	66.3	65.2	66.1	62.6	64.2	65.5	65.1	68.0	67.8
Non-Binary	~	~	~	~	~	~	~	~	~	~
I do not wish to disclose	7.1	5.6	5.4	5.1	5.7	5.1	6.0	6.9	4.7	5.6
Race (percent)										
American Indian or Alaska Native	1.2	.7	.9	.6	.7	.9	1.4	.8	.9	.7
Asian American	4.3	4.3	4.9	4.7	5.0	5.0	5.4	5.6	5.0	5.5
Black	18.0	16.4	18.6	17.5	18.8	18.2	16.8	18.2	17.5	16.0
Latinx	14.8	14.4	15.0	15.0	15.7	16.3	17.9	16.4	18.4	18.0
Native Hawaiian	~	~	~	~	~	~	~	~	~	~
White	48.6	47.4	47.5	48.4	44.9	47.7	47.6	47.5	47.7	48.2
I do not wish to disclose	17.1	17.0	16.5	15.3	15.8	14.7	15.8	14.1	12.5	13.9
Not listed	1.8	2.5	2.2	2.8	1.9	2.0	1.9	2.2	2.9	2.4
Role in school (percent)										
Teacher	46.9	44.2	45.5	46.1	43.1	43.8	44.4	44.4	46.5	48.0
Assistant Principal	28.9	28.3	26.3	26.4	27.0	27.3	27.0	26.9	26.1	26.6
Other	24.2	27.5	28.2	27.5	29.9	28.9	28.6	28.7	27.4	25.4
Science teachers (percent out of all teachers)	61.9	62.7	65.4	65.5	59.7	59.6	61.4	60.5	64.1	63.9
Appointment status: Volunteered (percent)	25.8	27.3	29.0	33.5	29.2	29.5	32.0	31.0	31.7	31.9
Years working at school (percent)										
Less than 2 years	9.5	9.8	7.2	6.5	6.4	7.5	9.5	10.1	10.8	11.2
Between 3 and 7 years	32.3	31.9	37.1	36.5	37.2	34.8	31.6	29.4	28.2	28.6
8 years or more	58.2	58.3	55.7	57.0	56.4	57.7	59.0	60.5	61.0	60.2

Results

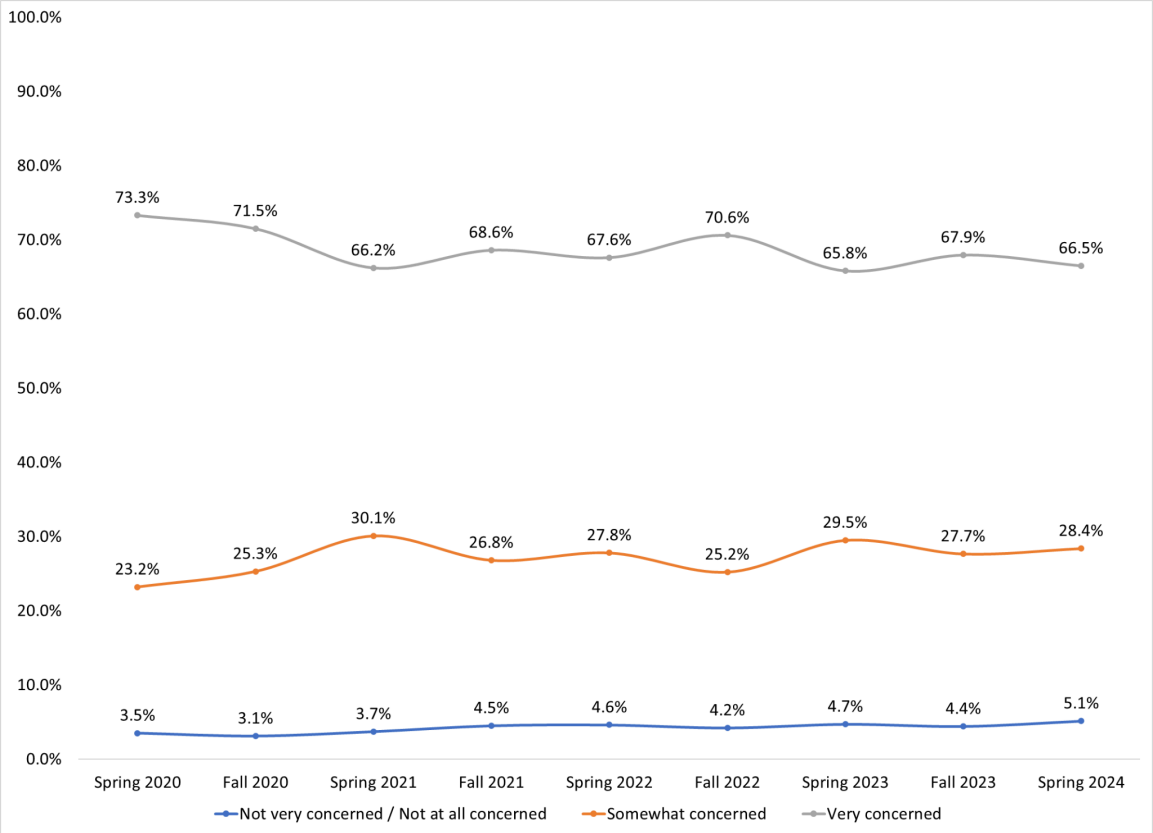
Educators' beliefs and attitudes toward climate change

Climate change poses a threat to ecological systems worldwide. International public opinion surveys indicate growing concern. We begin our analysis by exploring educators' levels of climate concern. As shown in Figure 1, in spring 2020, nearly all educators (96.5%) expressed concern about climate change. A majority (73.3%) reported being "very concerned," while about one-fourth (23.2%) indicated they were "somewhat concerned." A minority were not concerned about the issue, with 2.5% reporting they were "not very concerned" and 1.0% stating they were "not at all concerned."[4] Climate concern among educators remained stable between spring 2020 and spring 2024, with no statistically significant differences observed across the surveys or years.

[4] Given the timing of the survey, conducted a few months into the COVID-19 pandemic, we asked Coordinators whether their level of concern had changed due to the pandemic. Slightly more than one in ten (11.5%) reported that their views had shifted, with the majority of these respondents indicating they were now more concerned about climate change.

Figure 1

Percentage of responses regarding concern about climate change, by level and year

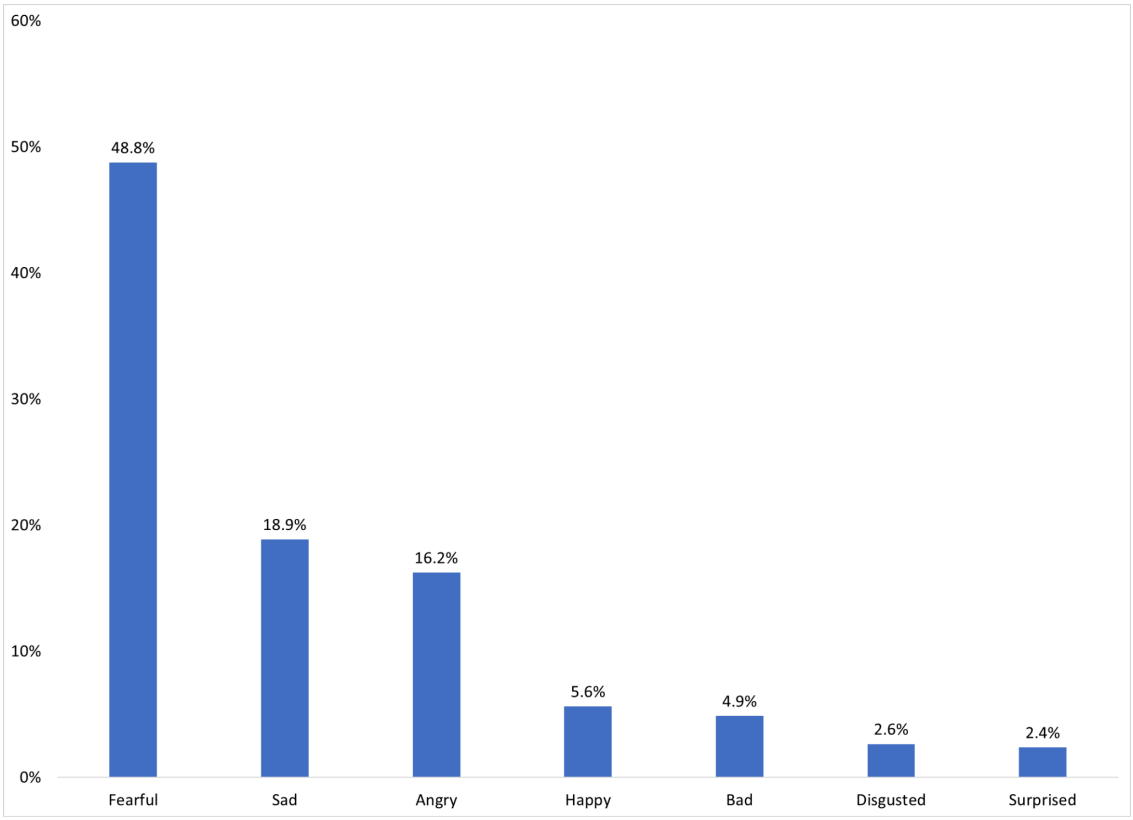


Emotional responses to climate change extend beyond mere concern, encompassing a range of feelings, which we explore in this analysis. In spring 2022, we asked respondents to share the emotions that come to mind when they think about climate change. A significant majority (79%) provided open-ended responses, which we coded and categorized into seven core emotions using a common emotion wheel.[5] The findings reveal that negative emotions overwhelmingly dominate among educators. Specifically, "fearful" was reported by 49% of respondents, followed by "sad" (19%) and "angry" (16%). Other negative emotions include "bad" (5%) and "disgusted" (3%). In contrast, positive emotions were far less common, with "happy" mentioned by 6% and "surprised" by only 2% of respondents.

[5] Emotions can be differentiated from related concepts such as feelings, affects, moods, and sentiments (see Thoits, 1989, for a review). They encompass four key components: (a) an appraisal of a situational stimulus or context, (b) physiological or bodily responses, (c) the expression—whether inhibited or freely displayed—of gestures, and (d) the application of a cultural label to specific combinations of these elements. The emotions wheel provides a structured and nuanced framework for recognizing and understanding emotions. While Panu Pihkala (2022) introduced a Taxonomy of Climate Emotions, this study utilizes a more general emotions wheel developed by Geoffrey Roberts (2015).

Figure 2

Frequency of core emotions when thinking about climate change[6]



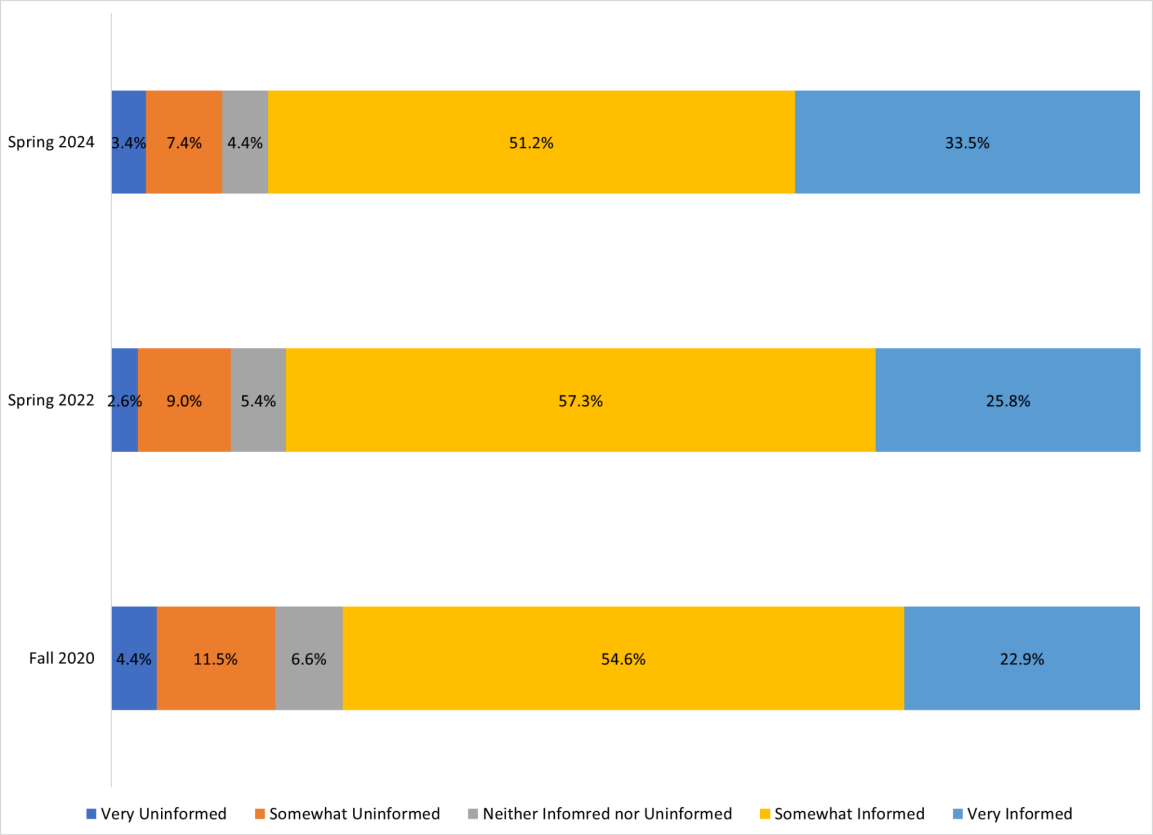
The causes of climate change are complex. Anthropogenic actions (i.e., burning of fossil fuels and deforestation) cause the planet to trap heat by altering natural processes, which are meant to keep the Earth's climate stable (IPCC, 2023). This complexity leaves room for misinformation, and efforts to spread disinformation over the role of fossil fuels in driving climate change further confuse the public. Understanding the causes and consequences of climate change is important to motivate climate action. This is important for educators tasked with engaging students with the topic and thus motivating them to demand change and a better planet.

[6] Fearful (e.g., alarmed, anxious, cautious, concerned, fearful, helpless, insecurity, nervous, panic, pensive, scared, terrified, trepid, uncertainty, worried)
Sad (e.g., apprehensive, defeated, depressed, despair, devastated, discouraged, disheartened, grief, guilt, heartbroken, hopeless, powerless, sadness, shame, unease, unhappy)
Angry (e.g., anger, annoyed, doubtful, frustrated, impatient, mad, outrage, rage, upset)
Happy (e.g., anticipated, calm, curious, determined, empowered, enthusiastic, hopeful, interested, motivated, optimistic, passionate)
Bad (e.g., apathy, bored, indifferent, numbness, overwhelmed, sorrow, stressed, urgency)
Disgusted (e.g., disappointed, discomfort, disgusted, disturbed, dreadful, unsettled)
Surprised (e.g., baffled, confused, cynical, disbelief, surprised, uninformed)

To assess educators' knowledge of climate change, we asked them to indicate how informed they feel about climate change. As shown in Figure 3, educators' perceived knowledge of climate change improved between fall 2020 and spring 2024. At the most recent measurement point, one-third of respondents (33.5%) reported feeling "very informed," while half (51.2%) indicated they felt "somewhat informed." Other respondents fell into the remaining categories, with 4.4% reporting they were "neither informed nor uninformed," 7.4% "somewhat uninformed," and 3.4% "very uninformed."[7]

Figure 3

Percentage of responses regarding feeling informed about climate change, by level and year



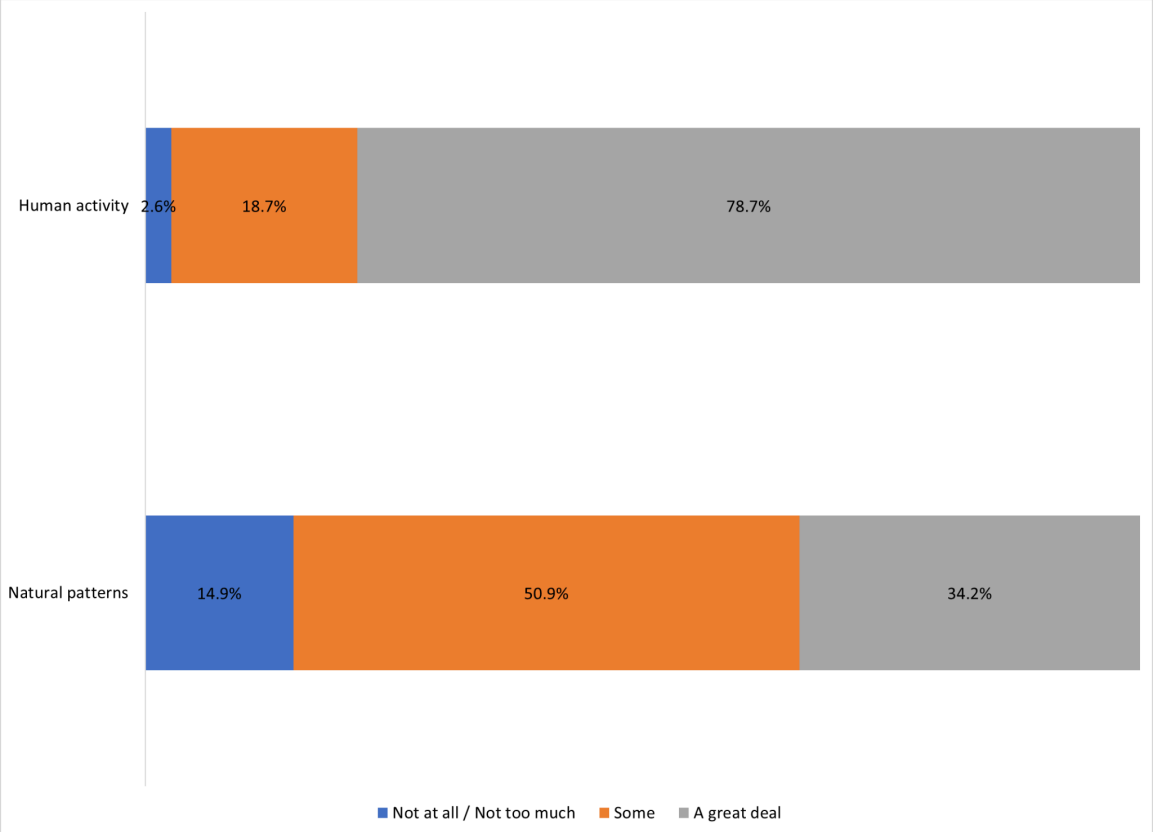
To examine educators' understanding of the causes of climate change, we asked respondents to evaluate the contribution of "human activity" and "natural patterns in the Earth's environment" to climate change. As shown in Figure 4, over three-quarters of

[7] In response to the survey question about which topics educators find most interesting for potential training sessions offered by the Office of Energy and Sustainability, 23% of respondents identified "climate change" as their top choice. While this indicates a notable level of interest, it ranked as the fifth most popular topic overall, suggesting that while climate change is a priority for some educators, other topics may have garnered broader appeal. Less than half of respondents (40.0%) said they would be interested in attending a training about CCE. Climate change is ranked fourth after green teams, growing and eating healthy food, and waste reduction & diversion.

educators (78.7%) think human activity contributes "a great deal" to climate change. About one-in-five (18.7%) thought climate change was "somewhat" attributed to human activity. Only a small percentage thought human actions were "not too much" or "not at all" a factor in climate change (2.6%). A little over a third (34.2%) of educators thought natural patterns in the Earth's environment play "a great deal" in climate change. Over half (50.9%) labeled natural patterns as "somewhat" involved in climate change. About 13.3% of educators thought nature played "not too much" of a role in climate change.

Figure 4

Percentage of responses for the contribution of human activity and natural patterns of Earth's environment to climate change



Another way to examine beliefs about the causes of climate change is to assess responses to both questions simultaneously. Table 3 presents a cross-tabulation in which each cell contains the percentage of respondents indicating the answers to questions. About half of the educators (45.2%) believe that human activity and natural patterns have an equal contribution to climate change (this group is represented on the diagonal of the table). Half of the educators (49.2%) believe that human activity contributes more than natural patterns (this group is represented in the cells below the diagonal of the table). Only five percent of the educators (5.5%) believe that natural patterns contribute more than human activity (this group is represented in the cells above the diagonal). A statistical

test revealed a significant association between educators' beliefs about the contributions of human activity and natural patterns to climate change. This means that their responses to the two questions were related rather than independent.

Table 3

Cross-tabulation of beliefs about the contribution of human activity and natural patterns in the Earth's environment to climate change

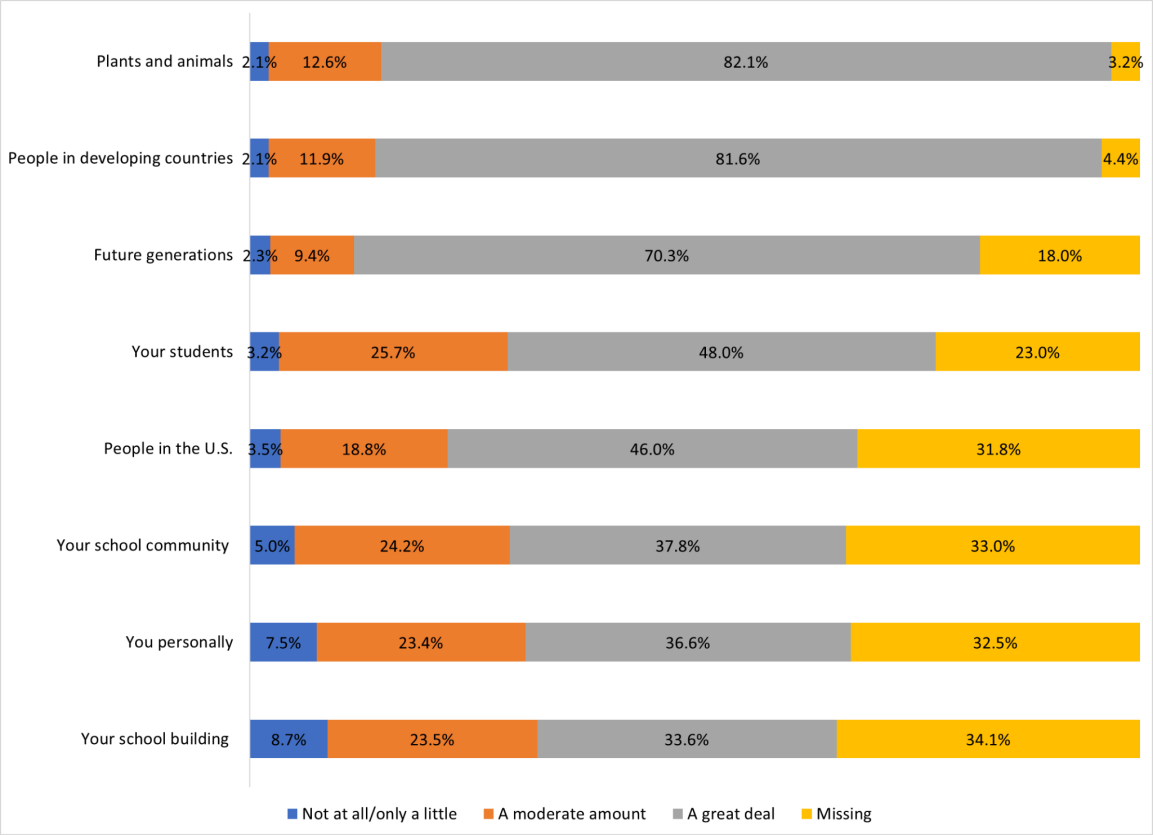
		Natural patterns			
		Not at all	Not too much	Some	A great deal
Human activity	Not at all	.3%	.1%	.3%	.1%
	Not too much	.0%	.5%	1.0%	.3%
	Some	.0%	.6%	14.4%	3.8%
	A great deal	1.3%	12.1%	35.2%	30.1%

Chi^2 = 206.76, DF = 9, $p < .001$, relative frequency of each cell

We asked educators to evaluate the extent to which climate change will harm different groups. Our analysis revealed a significant proportion of missing responses, with participants skipping some questions. To address this, we included the "missing response" category in our analysis. As shown in Figure 5, the majority of educators perceive the future harm of climate change as distant, temporally, and spatially. Most educators believe that climate change will cause a great deal of harm to non-human entities (plants and animals), people in developing countries, and future generations (82%, 82%, and 70%, respectively). Around half of the respondents expect that climate change will cause a great deal of harm to their students and people in the U.S. (48% and 46%, respectively). This figure drops to about one-third when respondents answer about the future harm of climate change to themselves and their school (community and building). We interpret the change in the proportion of missing information as an indication of confidence in answering questions. Educators appear more confident answering questions about non-humans and people in developing countries than those related to people in the U.S., respondents themselves, and their schools.

Figure 5

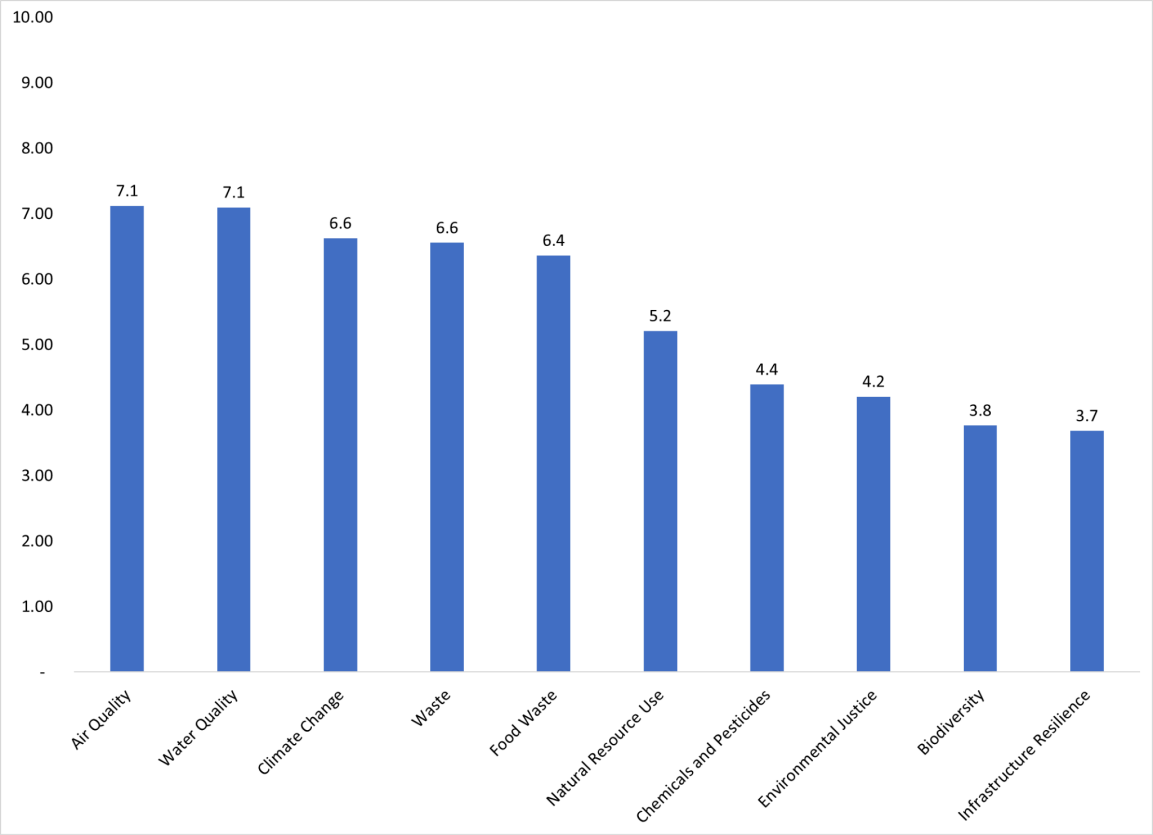
Percentage of responses for the future harm of climate change on different groups



Having explored educators' general attitudes toward climate change, we next turned to their perspectives on environmental issues specific to their local context—NYC. When asked to rank ten environmental issues facing the city, educators identified climate change as the third most pressing concern (Figure 6). About one-third (34.4%) of educators consider climate change the city's most critical environmental problem.

Figure 6

Importance of environmental issues facing NYC (mean)

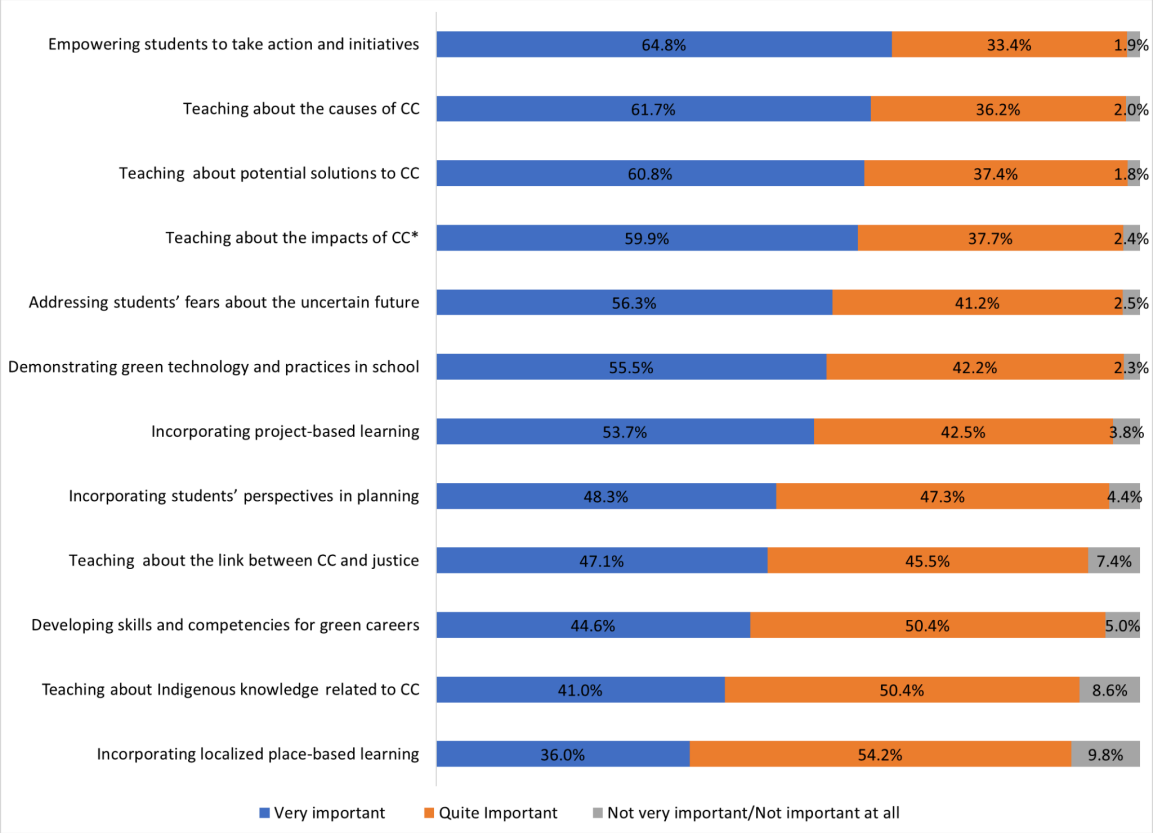


Educators' attitudes toward climate change education

We have examined educators' beliefs and attitudes toward climate change. Now, we explore beliefs about CCE. Nearly all educators in our sample (98.0%) agree that schools should teach about climate change. However, educators differ in how they prioritize various content areas and approaches to teaching about climate change (see Figure 7).

Figure 7

Percentage of responses indicating the importance of different approaches in climate change education



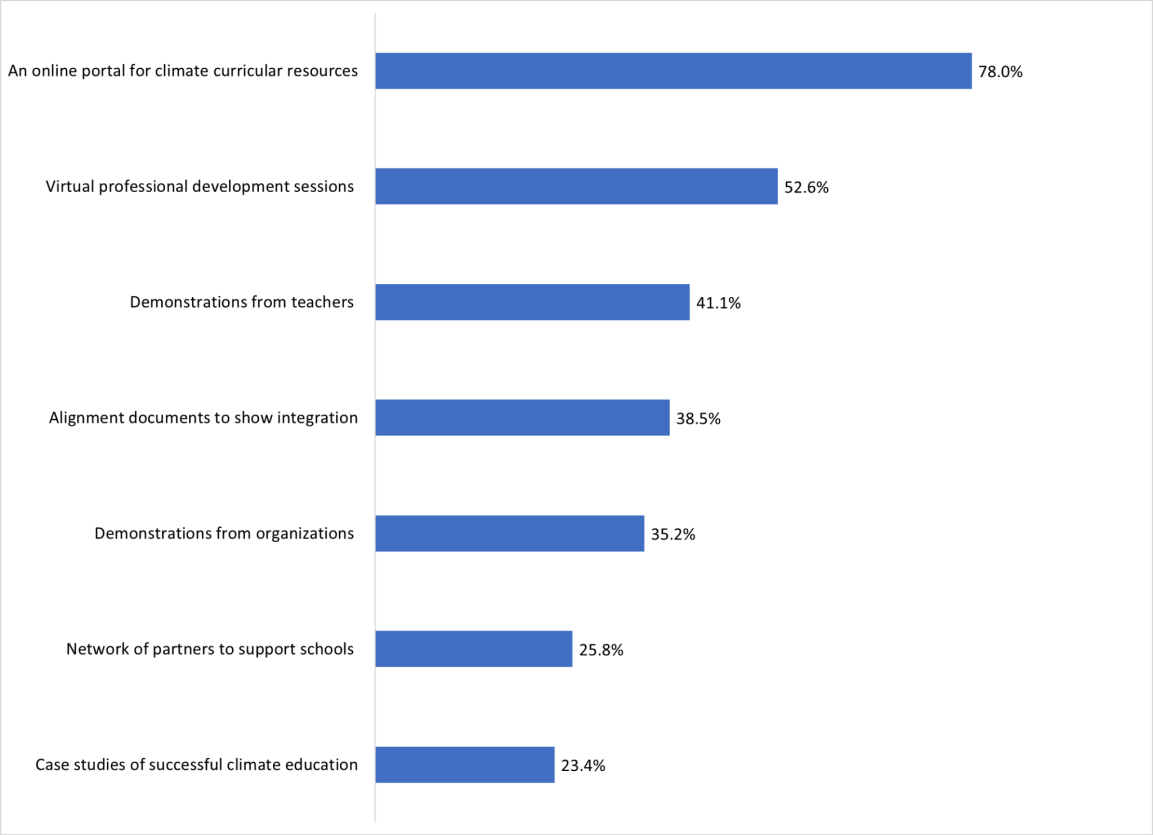
Reflecting international discourse on CCE (e.g., the UNFCCC ACE Framework), the majority of educators recognize the importance of empowering students to take action on climate change (64.8% rated this as "very important" and 33.4% as "quite important"). Similarly, most respondents support CCE that addresses not only the causes of climate change but also potential solutions and its impact (rated as "very important" by 61.7%, 60.8%, and 59.9%, respectively).[8] Educators also emphasize the importance of addressing students' emotional responses to climate change and the uncertainty of the future (56.3% rated this as "very important"). They endorse "hands-on" pedagogies, such as project-based learning and using schools as living laboratories. Compared to other content areas and approaches, however, educators are somewhat less enthusiastic about incorporating Indigenous knowledge and localized place-based learning into CCE.

[8] We explored how educators prioritize the teaching of different types of climate change impacts (available upon request). Educators are more supportive of CCE that addresses the impact of climate change on the environment than on the economy (rated as "very important" by 65.8% and 53.0%, respectively).

To enhance CCE and inform interventions, participants were asked to rate the importance of various resources and indicate their specific needs. A majority (59.5%) identified providing access to instructional materials about climate change as highly important, while 50% emphasized the importance of creating new instructional materials and offering high-quality professional development for teachers. In contrast, 40% considered mapping curricular connections to climate change in all state standards as highly important. Similar patterns emerged when educators were asked about resources they would find helpful for teaching climate change (Figure 8), with strong interest expressed in the virtual delivery of curricular resources (78%) and professional development sessions (52.6%).

Figure 8

Percentage of responses indicating helpful resources to teach about climate change

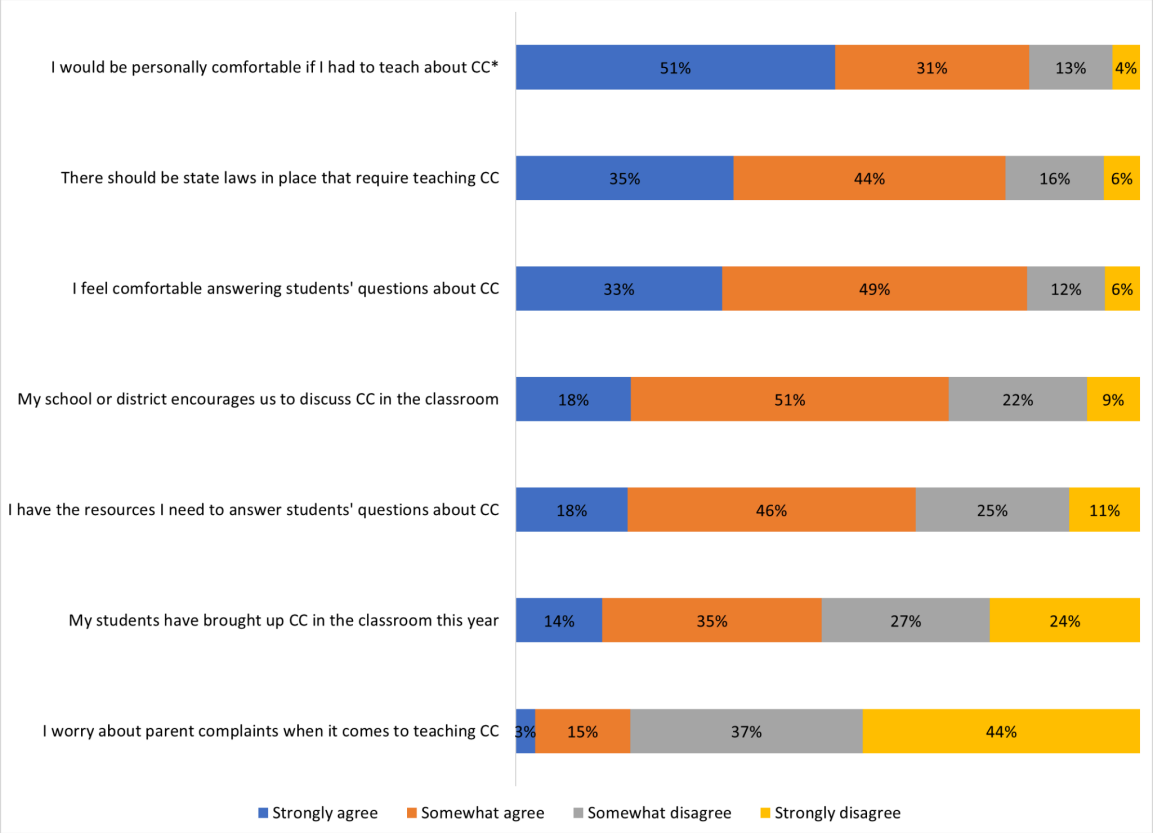


Beyond their views on the curricular aspects of CCE, several other factors influence educators' decisions to teach about climate change (see Figure 9). For instance, the majority of educators (82%) feel confident answering students' questions about climate change. About two-thirds report that their school or district encourages them to teach about the topic (69%), and a similar proportion (64%) indicate they have access to the resources needed to address students' questions. Half of the respondents note that students themselves have brought up climate change in the classroom. Despite this

support, challenges remain. In fall 2020, approximately one in five educators (18%) expressed concern about potential pushback from parents. On the policy front, most educators (79%) support state laws requiring the teaching of climate change, and a comparable percentage (82%) would feel comfortable if the state mandated such teaching. These findings highlight the opportunities and barriers educators face in integrating climate change into their teaching.

Figure 9

Percentage of responses to questions about climate change education

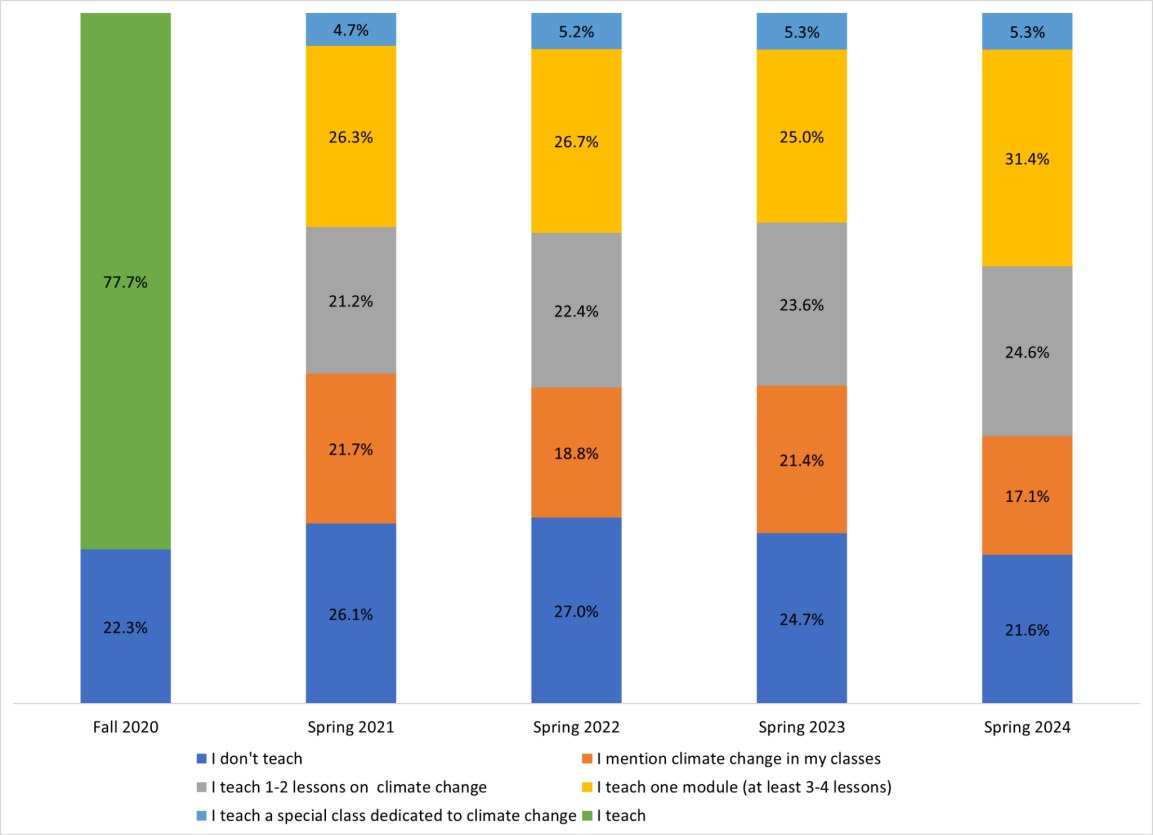


Teaching Climate Change

We examine two key CCE practices: teaching about climate change and engaging in discussions with students about climate change. A majority of teachers in our sample reported teaching about climate change, with more than 70% indicating this practice across all years (see Figure 10). Recognizing that teaching about climate change can take various forms, we asked teachers to specify the extent of their instruction. We observe an increase in the proportion of teachers who report dedicating significant instructional time to climate change, such as teaching at least one lesson (1–2 lessons), a module (at least 3–4 lessons), or a special class focused on climate change. In Spring 2021, 31% of teachers indicated teaching at least three lessons on climate change; by Spring 2024, this figure had risen to 36.7%.

Figure 10

Percentage of responses indicating the extent of teaching about climate change

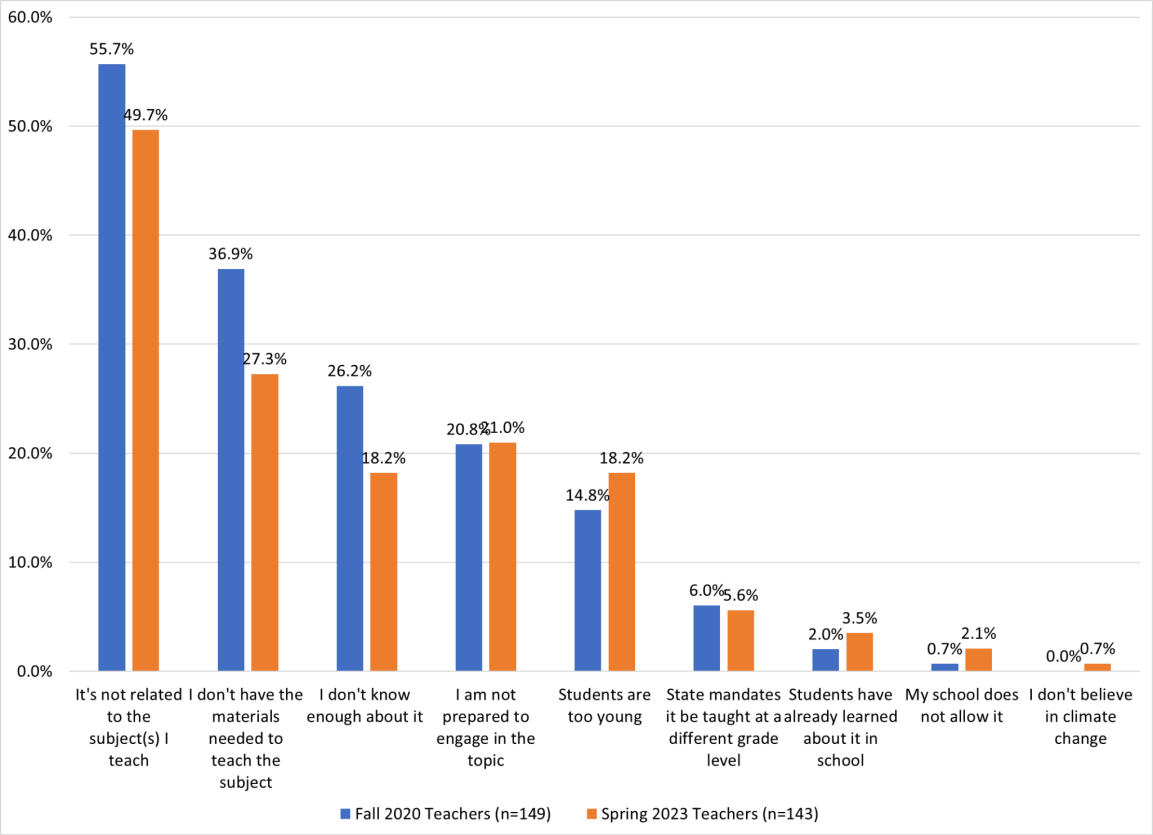


Analysis of the survey data reveals a clear association between grade level and the amount of instructional time devoted to climate change (Chi^2=25.37, DF=8, $p < .01$). Teachers at the middle and high school levels report dedicating significantly more classroom time to climate change topics than their counterparts in primary schools (respectively, 45.4%, 45.0%, and 28.0% indicate teaching at least three lessons on climate change). This pattern suggests that CCE is more frequently integrated into upper-grade curricula, potentially due to subject specialization, perceived student readiness, or alignment with academic standards at those levels.

To better understand the barriers to teaching about climate change, we asked teachers to explain why they do not address the topic (see Figure 11). The most cited reason was the perception that climate change falls outside of their subject area (55.7% in Fall 2020 and 49.7% in Spring 2023). Other frequently mentioned barriers include limited access to appropriate teaching materials, knowledge gaps, and a lack of preparedness to engage students on the topic. Comparing the two time points, we observe a decline in the proportion of teachers citing subject relevancy and access to materials as barriers. However, approximately one in five teachers still report feeling unprepared, which remains a significant barrier for not teaching about climate change.

Figure 11

Percentage of responses indicating reasons for not teaching about climate change



To provide a fuller picture of CCE in NYCPS, we now turn to our qualitative, open-ended response data. In four EYSS (2021-2024), we asked teachers to provide examples of how they teach about climate change. These responses help us to identify common practices and the underlying themes that guide teachers' work around CCE (outlined below).

Science lessons – seamless integration. Teachers were most likely to teach about climate change through science lessons, although science teachers reported varying frequency and depth of their climate change lessons. Teachers highlighted multiple units where they integrate climate change: Alternative Energy Sources, Carbon Cycle, Human Impact on Earth's Climate, Investigating Weather and Climate, Living Environment, Plant and Animal Adaptations, and Urban Agriculture. High school teachers indicated teaching about climate change and related topics as part of their AP Environmental Science Class. Respondents wrote that climate change was "easily incorporated into my science lessons" (Spring 2021) and presented the topic as "a natural fit in many of our science lessons" (Spring 2023).

Multi-disciplinary approach – a pathway for non-science teachers. Fully understanding the climate crisis requires examining historical contexts, cultural influences, social structures, and artistic expressions. Educators across disciplines found creative ways to integrate climate change into their teaching. For example, a fashion design instructor explored climate change by demonstrating "how the fashion industry has helped to create the issues we have today, ways we can combat them, and how we can affect change" (Spring 2021). A literature teacher incorporated realistic fiction, nonfiction articles, and students' climate narratives to "facilitate discussion and encourage problem-solving activities to address environmental inequities" (Spring 2022). A dance educator highlighted the role of the arts in helping students express their concerns and emotions about climate change:

> The Great Kapok Tree Choreography Unit (students choreograph a dance inspired by Amazon Ecosystem, Interdependence) Commotion in the Ocean Unit (students choreograph a dance inspired by Ocean Ecosystems, the effects of pollution, and solutions to the problem) Justice Dances (student write poems about injustice and how to solve it and choreograph interpretive dance solos) Earth Day Dances (students write poems about sustainability challenges we face globally and choreograph interpretive solos) (Spring 2021).

Weaving climate change into the curriculum. Many teachers took a holistic approach to CCE, integrating climate-related topics across multiple subjects rather than confining discussions to isolated lessons. Teachers embedded climate change into science, social studies, English Language Arts (ELA), and mathematics by making connections between climate issues and broader themes such as environmental justice, food security, and energy systems. One elementary school teacher wrote: "As a Science teacher, I infuse the conversation in just about every topic in science […] but I also include these conversations whenever I can into my Social Studies, ELA, and Math lessons" (Spring 2021). Another teacher shared how they used a lesson about the Industrial Revolution to teach how "it changed the way humans live on the planet and consume energy" and the implications for climate change.

Connecting climate change with students' lives. Teachers implemented several key strategies identified by Monroe et al. (2017) in their systematic review of effective CCE approaches. In particular, teachers emphasized making climate change relevant to students by connecting it to their local environment and personal experiences. Many teachers leveraged current events to make climate change tangible: "I use headlines about warming temperatures, rising seas, and stronger storms to help students understand the immediate impacts of climate change" (Spring 2021) and "I tie in weather/natural events like how the current wildfires in Canada are affecting our air quality" (Spring 2023). Others localized climate change effects by relating them directly to students' surroundings: "As we study ecosystems, we also examine our own

community's ecosystem—specifically, how the lack of green spaces impacts air quality and public health" (Spring 2022).

Engaging students about climate change, beyond the classroom, and by non-teachers. Understanding that not all educators in a school teach in a formal capacity (e.g., assistant principals, librarians, parent coordinators), we asked respondents whether they have casual conversations with students about climate change. In general, about two-thirds of educators reported engaging in discussions about climate change with students. Similar to trends in teaching about climate change, we observed an increase over time in the proportion of respondents who reported discussing climate change frequently, sometimes, or often. In Spring 2022, 55.8% of educators, who are not teachers, indicated they talked about climate change sometimes or often; by Spring 2024, this figure had risen to 67.1%.

Our qualitative, open-ended response data is helpful to illuminate the ways that educators engage with CCE beyond the classroom. We asked educators to share examples of when they talked with students about climate change. We found that informal conversations about climate change touch on many of the same topics that curricular CCE addresses, such as temperature rise, extreme weather events, and local/global events (e.g., Earth Day celebration). Educators articulated the inevitability of these conversations:

> This year has been another challenging one. The tracking of temperature change alone and looking at what is currently happening here as well as in other states and countries, and its effects on climate, produce, living circumstances, and environment has been infused into teaching (Spring 2021).

Educators described how conversations about climate change vary across age groups:

> The conversation with students about global climate change is age-appropriate to the students' cognitive or developmental capacity. Older students will challenge and talk more openly depending on their exposure and prior knowledge. [With] younger students, we begin by connecting the kids with nature (Spring 2021).

We found that these conversations often addressed individual actions that students could take toward mitigating climate change. One educator shared that she brings up climate change "when we do [clothing] drives, I explain the importance [of reducing] waste. When students ask me how come I don't eat meat" (Spring 2021). And another educator described engaging in climate change conversation, "When waste is observed or certain behaviors that impact our climate, like littering" (Spring 2022). More often than not, these actions dealt with waste management (recycling, reducing food waste). While waste management is one strategy a community can take to reduce its greenhouse gas emissions, there are many others (sustainable architecture, renewable energy

integration, electrification and expansion of public transport, energy efficiency improvements, food procurement choices, etc.) that have received little to no attention.

Green Teams – potential spaces for climate conversation and learning. Regardless of whether they are teachers or not, educators in our survey mentioned their "Green Team" as a space for engaging students with climate change. Per NYCPS materials, a Green Team is "an independent group or part of Student Government or other school club (e.g., science club) that is dedicated to improving sustainability through projects, awareness, and actions." The composition of Green Teams varies by school. Some consist of students, while others include students and adults, such as teachers and community members. Educators engaged Green Teams in in-depth discussions of the link between climate change and other systems. One teacher, for example, wrote: "I shared a lesson with my Green Team about Edible Gardening wherein we talked about the amount of Greenhouse Gas Emissions due to an industrialized food system, so having local produce would decrease greenhouse gas emissions" (Spring 2022). Educators also used Green Teams to support students in translating knowledge into action:

> I designed a 3-day lesson on Climate Change in lieu of the celebration of Earth Day […] The outcome of the lesson was producing one of the following projects: slogan writing, poster making, write and present a rap song, or write a poem (Spring 2021).

Our findings highlight the diverse ways that educators integrate climate change into their work at school. They adopt creative, interdisciplinary approaches to make climate change relevant and to foster meaningful discussions. From incorporating climate themes into existing subjects to leveraging extracurricular activities like Green Teams, educators find innovative ways to engage students. These efforts not only enhance climate literacy but also empower students to take action within their communities.

Discussion and Conclusion

Responses to climate change—whether through mitigation or adaptation—are widely debated among policymakers, the public, and researchers. The education sector is no exception. While there is growing consensus that education must play a central role in long-term climate strategies, debates persist over how best to leverage K-12 schools, colleges, universities, and non-formal organizations. In K-12 education, a key challenge is integrating climate change across subjects and ensuring that all teachers, regardless of their training or discipline, are equipped and motivated to teach it. In contrast to previous studies that primarily focus on science teachers or teachers' knowledge of climate change, this article shifts attention to the *whole* educator, examining attitudes, emotions, and perspectives on CCE. It also explores how school-based educators, including teachers and other staff, already engage with climate change. Using multiple surveys from an ongoing research-practice partnership, we report on four key findings.

Our study highlights the complexity of how teachers engage with climate change. The vast majority of educators express concern about climate change, with many reporting emotional responses such as fear, sadness, and anger. Educators in our sample exhibit greater concern about climate change than the general U.S. population: 95% of NYC educators are very or somewhat concerned, compared to 65% of Americans (Leiserowitz et al., 2023). Although we have some indication for improvement (see Figures 3 and 11), many educators lack confidence in their knowledge of climate change (with about one-third feeling "very informed" about the topic in the most recent data point). Educators' views on the causes of climate change corroborate this sentiment. While the majority of educators endorse the scientific consensus on the role of human activities (e.g., burning fossil fuels) in climate change, a sizable group also endorses an alternative explanation attributing climate change to natural patterns. About half of the educators in the sample give equal importance to these two competing explanations. Similar to the general public in the U.S., educators tend to underestimate the extent to which climate change will harm them and their local community (Leiserowitz et al., 2023).

Our study underscores widespread support for comprehensive CCE. Educators overwhelmingly support teaching climate change in schools. They prioritize empowering students to take action and addressing causes, impacts, and solutions (see Figure 7). Many value supporting students' emotional responses and uncertainty about the future. However, educators show comparatively less enthusiasm for incorporating Indigenous Knowledge and localized place-based learning into CCE. It is unclear, at this point, why educators present these preferences. Similar patterns are found in public opinion studies in the U.S. concerning support for different aspects of CCE (e.g., Pizmony-Levy et al., 2024). Educators may be reflecting broader societal attitudes toward diverse ways of knowing, or they may be perceiving and adapting to these sentiments in their teaching practices. Educators feel comfortable teaching and answering students' questions about climate change (see Figure 9).

Our study documents the extent of teaching about climate change and the creative ways teachers teach this topic. Compared to other teachers in the U.S., teachers in NYC are almost two-times as likely to say they teach about climate change (40% vs. 77.7%; NPR/IPOS, 2019). Within five years, we observed an increase in the intensity of teaching about climate change in NYC, in that more teachers spend more time teaching about climate change (see Figure 10). Open-ended responses show that science teachers have curricular anchors and templates for engaging with climate change. These educators can point to specific learning units that already address climate change or could serve as an opportunity for this content. Teachers of other subjects shared their practices, detailing how they found ways to connect climate change to their subject.

Our study points to three barriers shaping educators' engagement with CCE: perceptions, access to resources, and feelings of preparedness. Perceptions influence

whether educators integrate climate change into their teaching, with many teachers excluding the topic because they see it as unrelated to their subject area. School leadership and district support appear limited—only one in five educators strongly agree that their school or district encourages them to discuss climate change in the classroom. This lack of endorsement may reinforce the perception that CCE is optional or outside their professional responsibilities. Accessing resources presents a challenge. Teachers highlighted the importance of having the materials needed to teach about climate change (see Figures 9 and 11). Four out of five teachers pointed to an online portal for climate curricular resources (e.g., Subject to Climate or local, district-managed hubs) as a helpful intervention. Feelings of preparedness impact engagement with CCE. One in five teachers who do not teach about climate change cite a lack of preparedness as a key reason. A large group of educators points to professional development sessions and demonstrations from other educators and organizations as valuable tools for effectively incorporating climate change into their instruction. Even when educators recognize the importance of CCE and have access to resources, they may still hesitate to address the topic due to a lack of confidence in their knowledge or teaching strategies.

These findings provide valuable insights into educators' engagement with CCE and raise important questions about how these trends compare to national patterns. Comparing our findings to a nationwide survey of teachers (NPR/IPOS, 2019), we find that teachers in NYC hold more favorable attitudes toward CCE than teachers nationwide. NYC teachers are more likely than their peers nationwide to feel encouraged by their school or school district to teach about climate change (69% vs. 37%, strongly and somewhat agree) and to recognize students' interest in the topic (49% vs. 41%, strongly and somewhat agree). NYC teachers are less likely than their peers nationwide to worry about parental complaints related to climate change instruction (18% vs. 29%). Context matters. NYC's relatively environmentally progressive policies and culture appear to influence how educators engage with CCE. Interventions should be tailored to local contexts, ensuring that support for CCE aligns with regional attitudes and policies.

What explains the improvements in teachers' climate change knowledge and their engagement with CCE over time? Several factors may contribute to these positive trends. First, increased public discourse and awareness around climate change (Leiserowitz et al., 2023; Tyson et al., 2023) have likely influenced educators' perceptions and knowledge. As climate change continues to be a prominent issue in media, politics, and public discussions, teachers are exposed to more information, which may contribute to their growing confidence in understanding and teaching the topic.

Second, local policy and programming may play a role. NYCPS has introduced CCE-focused initiatives in schools, including professional development opportunities (e.g., workshop series, and Mid-Winter Climate Institute) and city-wide campaigns (e.g., four Climate Action Days per year starting in the 2023/24 school year). NYCPS

convened the Climate Education Leadership Team (CELT), a group of over 30 educators who help design professional learning, develop curriculum resources, and build a citywide network to support the integration of equitable climate education across all subjects and school communities. These efforts may have helped equip educators with the knowledge and tools to integrate climate change into their teaching. As more teachers begin to engage with CCE, they share ideas, resources, and best practices with colleagues, fostering a ripple effect that enhances teacher preparedness.

Third, student activism and interest in climate issues may motivate educators to prioritize climate change in their instruction. With student-led climate movements gaining momentum, educators may feel a greater responsibility to respond to student inquiries and integrate climate-related topics into their teaching. Taken together, these factors help explain the positive trends in teachers' climate knowledge and teaching practices, underscoring the importance of sustained institutional support, professional learning opportunities, and responsive education policies in further advancing CCE.

Our study is a step toward a more comprehensive understanding of educators' engagement with CCE. Our study draws on data from a specific context—NYC, a global city within a high-income country—and from educators who are appointed or responsible for advancing sustainability initiatives at their schools. While this provides valuable insights from the majority of the schools in the NYC system, it does not capture the full spectrum of teachers and school staff who may engage with CCE in different ways. Future research could include data from representative samples of teachers and educators to ensure a broader and more generalizable understanding of CCE. Research should incorporate more qualitative data, such as interviews, focus groups, and classroom observations, to better understand how teachers make sense of climate change and navigate the broader educational landscape, including policies and practices related to CCE. Expanding the scope to multiple contexts will also be critical for examining how socio-political and educational environments shape teachers' engagement with CCE. International large-scale assessments such as TIMSS 2023 (von Davier et al., 2024) and TALIS 2024 provide valuable opportunities for cross-national and comparative analyses, enabling a deeper exploration of these dynamics on a global scale. Integrating data from diverse contexts and representative samples, future research can offer a more nuanced and comprehensive picture of the challenges and opportunities in advancing CCE.

This study provides valuable insights into conducting research within the context of a research-practice partnership. Through ongoing dialogue and a shared commitment to learning from each other, our partnership evolved from a broad focus on sustainability to a targeted emphasis on CCE. We learned a key lesson from this collaboration: how to collect comprehensive data on educators—their emotions, attitudes, and instructional practices—without overwhelming participants with lengthy survey instruments. By working closely with district leaders, we were able to refine our approach (see Table 1) and ensure that data collection remained meaningful and manageable. Because this

study was embedded within a research-practice partnership, we were able to translate findings into action quickly. For example, we co-designed a Summer Institute*:* Integrating Climate Change in NYC Public Schools (Gardner, 2023). Findings from our study directly informed the objectives and content of the Institute, in which we sought to: deepen teachers' understanding of climate change through direct engagement with climate scientists, empower teachers to integrate climate change across diverse subjects by connecting them with curriculum experts from TC and NYCPS, build a supportive learning community of educators from across the city, fostering sustained collaboration, and co-create innovative teaching materials tailored to NYC's unique educational context. This experience underscores the power of research-practice partnerships in bridging the gap between research and implementation, ensuring findings are academically significant and practically impactful.

CCE has evolved as a field over the past decades, shaped by international frameworks such as Action for Climate Empowerment (ACE). While these global discourses provide valuable guidance, it is crucial to pay close attention to what happens on the ground—how educators experience, interpret, and implement CCE in their daily work. This study contributes to this effort by taking a whole-educator approach, examining not only teachers' knowledge and instructional practices but also their emotional responses to climate change and attitudes toward CCE. By centering educators' perspectives and lived experiences, we gain a richer understanding of both the opportunities and challenges in advancing CCE. Continued attention to teachers' needs, grounded in local realities and collaborative partnerships, will be essential in shaping effective and sustainable climate education initiatives.

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Teacher Resilience in the Aftermath of the 2022 Balochistan Floods: Coping Strategies and Educational Continuity in Primary Schools

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This study analyzes teacher resilience in light of the 2022 floods in Balochistan, Pakistan, as teachers were displaced. It explores the challenges primary school teachers faced during this climate-induced displacement, how they coped, and the role of community and institutional support in continuing education. Using semi-structured interviews and focus groups (n=15), the study reveals how teachers adapted to teaching methodologies, negotiated emotional and psychological challenges, and utilized community resources to overcome the devastation brought about by floods. The findings show that teachers employed several adaptive strategies: remote teaching, collaborating with colleagues, and enacting personal resilience mechanisms such as emotional regulation and social support networks. The study revealed stark differences in how urban teachers experienced the floods compared to that of rural teachers, including hurdles imposed on teachers in rural areas due to a lack of resources, infrastructure, or both. The results are critical in guiding future educational policies and teacher development programs in disaster-prone areas in Pakistan, informing the operational needs of educators during post-disaster recovery, and urging a long-term approach to enhance the resilience of educational systems.

Keywords: Teacher resilience, Balochistan floods, climate-induced displacement, coping strategies, educational continuity, adaptive teaching.

Introduction

The catastrophic 2022 floods in Pakistan's Balochistan province serve as a reminder of how climate disasters target the world's most vulnerable, exposing the fragility of marginalized regions and the dire consequences of global inaction (Rashid & Qixiang, 2025). The floods, exacerbated by torrential monsoon rains, struck 32 out of 34 districts in the province, forcing thousands of students and educators to evacuate (Alied et al., 2023). The 2022 floods displaced over 20,000 people, ripped up more than 1,000 km of roads, and devastated the province's schools, damaging 2,850 institutions and destroying 1,076 (Government of Balochistan, 2023).

The 2022 floods turned schools into temporary shelters, disrupting education, a cornerstone of community resilience, and complicating the continuity of teaching and learning (Manzoor et al., 2023). 577 schools were used as shelters, and 977 classrooms were destroyed. The floods displaced 658,871 students (including 251,840 girls), denying them access to their schools for weeks and exacerbating pre-existing inequities among rural, female, and otherwise vulnerable learners. The education sector of Balochistan suffered PKR 12,439.2 million (USD 43.8 million) in losses, underscoring the huge economic and social costs of the disaster (Government of Balochistan, 2023).

Teachers' resilience proved significant in ensuring the continuity of education for students. The first responders to educational disruptions were primary school teachers, who experienced unprecedented challenges in delivering instruction while responding immediately to the displacements, losses, and uncertainties resulting from the disaster (Noviana et al., 2023). Teachers operate in unique environments, and teachers are held responsible for adapting to these rapidly changing and unsafe environments to ensure that there will be learning during and after a disaster (Ioana, 2024).

The 2022 floods in Balochistan highlighted the education sector's vulnerability to disasters and demonstrated the necessity of teacher resilience in post-disaster situations. To inform future disaster preparedness and educational recovery plans, it is important to understand how teachers coped with the challenges the floods pose and what strategies they used to adapt to the new reality. This research examines the resilience mechanisms that primary school teachers in Balochistan employed after the floods, and the socio-cultural, institutional, and personal factors that shaped those adaptive responses.

Research Problem Statement

The floods wiped out multiple schools in Balochistan, Pakistan. Schools went underwater and others were demolished (Aman et al., 2025). Students relocated to emergency shelters, lacking proper educational facilities and resources (Government of Balochistan, 2023). In the aftermath, teachers held lessons in cramped, improvised tents or community halls and without timely support from education authorities or aid agencies, schooling was disrupted (Ismail et al., 2024; Krisna et al., 2023). Education staff and students experienced psychological trauma, while teachers suffered personal setbacks through home destruction and enduring displacement (Jaffar et al., 2023).

The floods spotlighted teacher resilience; which is defined as teachers sustaining their work through uncertain times when facing individual and workplace challenges (Yuksel & Akbel, 2023). There is limited research on how teachers in Pakistan, particularly in disaster-prone and under-resourced regions like Balochistan, demonstrate resilience in the aftermath of climate-induced displacement. Educational practices of teachers during and after disasters need examination to develop better policies for disaster preparedness, teacher training programs, and education recovery strategies.

Research Questions

This study explores the intersection between teacher resilience, climate-induced displacement, and education in the context of the Balochistan floods.

1. How do primary school teachers experience and exhibit resilience in post-disaster settings, particularly in light of their personal experiences with displacement?

2. What strategies do primary school teachers use to maintain educational continuity in the aftermath of floods?

3. What role do local communities and governmental or non-governmental support systems play in supporting teacher resilience in disaster-affected areas?

These questions provide insight into how teachers maintain their professional commitment to education under crisis conditions and the factors that influence their ability to be resilient in the face of climate-induced displacement.

Relevance

This work contributes to the growing literature on teacher resilience and disaster recovery in education through its focus on climate change and displacement (Borazon & Chuang, 2023; Clarà et al., 2025; Fu & Zhang, 2024; Raghunathan et al., 2022; Rashid & Qixiang, 2025). This study offers insights into how teachers in Balochistan strategically navigate psychosocial and pedagogical challenges during the post-disaster recovery process, highlighting their adaptive capacity in maintaining educational continuity amid displacement and disruption. This study adds to the literature on climate-induced displacement and challenges in displaced communities' access to quality education, calling for policy interventions that support educators during and after a disaster.

This study focuses on one disaster in one vulnerable region. Its goal is to use the localized understanding of teacher responses to post-crisis realities to address broader dynamics of emergency pedagogy. Results can guide the development of disaster resilience programs for teachers, curriculum adaptations, and strategies for future disaster preparedness. This research offers evidence-based recommendations for supporting teachers in regions most impacted by climate displacement and disasters, which can be used to inform educational policy. Beyond its regional focus, the study's findings have relevance for international frameworks on educational resilience.

Literature Review

This study draws on resilience theory and ecological systems theory to analyze teacher responses during the Balochistan floods. While resilience theory provides a foundation for understanding teachers' emotional and professional adaptation to crisis, ecological systems theory helps situate these responses within a broader network of interacting systems, ranging from personal support networks to institutional structures and national policies. These frameworks offer a more holistic understanding of teacher resilience by

capturing the individual-level coping strategies and the systemic influences that shape educational continuity during climate-induced displacement.

Resilience Theory in Education

Resilience theory examines individual and institutional responses to disruptive events like natural disasters. According to Masten (2001), resilience means maintaining functionality while adapting to challenges and recovering after adverse situations. In a review of resilience in health education, McAllister and McKinnon (2009) emphasize the importance of teaching resilience to teachers as a personal capacity and a skill shaped through professional practice. Mustak (2022)emphasizes that teachers often act as critical agents of education continuity, relying on personal coping strategies and informal community support when institutional aid is limited.

Ahmed and colleagues (2022) document how floods have severely impacted children's education and highlight the critical role teachers play in restoring stability and instruction in Pakistan. Their findings suggest that teachers are central to education delivery and students' emotional recovery in the wake of displacement. Kothiyal and Halder's (2024) study on cyclone-prone Odisha demonstrates how educators operate with limited resources, relying on community networks and improvisation to sustain learning. These studies underscore the dual dimensions of teacher resilience—emotional and professional—and offer valuable insight into the experience of teachers in disaster-affected regions like Balochistan.

Through a resilience theory framework in educational settings (Gu & Day, 2007; McAllister & McKinnon, 2009), we observe methods teachers use to handle professional difficulties and personal hardships to sustain educational activities and preserve their sense of control. The ability of teachers to foster student resilience and sustain education following disasters depends on their emotional health, combined with adaptability in their profession and institutional resources available.

Ecological Systems Theory and Education

Bronfenbrenner's ecological systems theory (1979) offers a framework that demonstrates multiple influencing layers that act together to affect people, including educational professionals, in their social surroundings. Multiple interconnected systems impact individuals who consist of immediate environments such as family and classroom (microsystem), the interactions between different microsystems (mesosystem), external environments that affect them indirectly, including policies made by local governments (exosystem), and wider societal and cultural factors (macrosystem).

Through teacher resilience during post-disaster educational situations, teachers rely on their capabilities and support mechanisms maintained at the community, institutional, and policy dimensions per the ecological systems theory. Teacher resilience during adversity develops through interactive contributions from family support networks combined with community involvement and institutional preparedness alongside

government policy implementation (Nordgren, 2022). Adapting to post-disaster settings, teachers demonstrate individual strength in connection with community recovery processes, along with institutional capabilities and the implementation of national guidelines.

Ecological systems theory enables the study of how multiple interconnected systems in communities work together to establish educational practices while supporting teacher resilience. Educational continuity throughout a crisis depends upon how effectively distinct systems within a community work together. To build successful teacher assistance programs that function in areas facing natural hazards, such as Balochistan, we must grasp how interconnected systems affect education systems.

Previous Studies on Teachers and Climate Disasters

Research into teacher resilience after climate-induced disasters has become vital, particularly for highly disaster-prone areas such as South Asia. In India, Bangladesh, and the Philippines, researchers found significant teacher responses to floods, cyclones, and other climate disruptions (Ullah et al., 2025). Ullah's (2025) research establishes community-based support, together with adaptive teaching practices and psychological resilience, as essential components to maintain educational services during crises.

In a review of climate change perception in education, Ahmed and colleagues (2021) found that teachers and students demonstrate an awareness of the global impacts of climate change and link its causes to human activity. The study notes that prior exposure to disasters can influence teachers' attitudes, preparedness, and adaptive capacity. Teachers working in vulnerable areas are key stakeholders in post-disaster education recovery and vital contributors to climate education in their communities.

Existing literature does not sufficiently address teacher resilience dynamics operating under climate-induced displacement conditions in flood-prone Balochistan. Several studies examine educational responses in other regions and specific disaster types (Ahmed et al., 2022; Kothiyal & Halder, 2024). Other research explores development challenges in Balochistan, such as agricultural adaptation (Khan et al., 2023) and water governance (Yasin et al., 2020). Detailed evaluations of teachers working amid climate-induced displacement in chronically affected areas of Pakistan remain lacking.

The growing severity of natural disasters, largely due to climate change, necessitates an understanding of teacher resilience in maintaining educational services within regions hit by disasters, such as Balochistan. Research has yet to analyze how community support systems, alongside institutional structures and national policies, help develop teacher resilience in disaster-prone regions and, specifically, how teachers navigate their roles in disaster-affected areas of Pakistan, where displacement is recurring and institutional support is limited. This study addresses that gap by examining the lived experiences of primary school teachers in flood-prone Balochistan, shedding light on the resilience strategies they adopt in the face of long-term climate disruptions.

Theoretical Framework

Resilience Theory in Educational Contexts

Resilience theory, as postulated by Masten (2001), sees resilience as a dynamic process through which individuals or systems maintain or recover functioning in the presence of adversity. It is based on the interaction between the destabilizers, such as risk factors (e.g., displacement and loss of resources), and the protective processes (e.g., social support, self-efficacy, and adaptive coping) that protect against these threats. Resilience explains itself among four interrelated capacities.

- **Resistance:** Obtaining small initial effects of stressors,
- **Recovery:** Restoring previous levels of functioning,
- **Adaptation:** Flexibly changing strategies in changing conditions.
- **Growth:** Making positive change, to move beyond the pre-crisis baseline (Masten, 2001; McAllister & McKinnon, 2009).

Pedagogical Resilience. Pedagogical resilience that recognizes how teachers innovate or adapt instructional procedures to maintain learning during disruptions (Mansfield et al., 2016). Examples are multi-grade lessons upon destruction of classrooms (adaptation) or use of open spaces to ensure student engagement (growth).

Community Resiliency Roles. Teachers are a part of local support networks or what Martinsone and Žydžiūnaite (2023) refer to as community resiliency roles. Educators broker protective processes by liaising with families, NGOs, and community elders to source resources (resistance), restore routines (recovery), and co-construct new learning environments (adaptation/growth).

Application to Balochistan's 2022 Floods

Teachers' resistance was observed in their quick establishment of peer support circles; recovery unraveled as they repaired makeshift classrooms; adaptation was a consequence of improvised curricula using local materials; and growth took the form of community-led psychosocial activities going beyond the pre-flood activities. This framework informed our study on how primary school teachers in Balochistan utilized individual, pedagogical, and community resources in maintaining the continuation of education amid climate displacement.

Ecological Systems Theory and Climate-Induced Displacement

Bronfenbrenner's ecological systems theory (1979) frames individual experiences within five nested environmental layers, each of which shapes how teachers and students navigate climate-driven upheaval. Applied to the Balochistan floods, this lens reveals multiple points of intervention for sustaining educational continuity.

Microsystems. At the most immediate level, displacement ruptured the classroom–home nexus. Teachers were uprooted from familiar schools and thrust into camp-style shelters or overcrowded community spaces, while students contended with family loss, food insecurity, and fractured peer networks—factors shown to undermine learning and well-being (Wiedermann et al., 2023).

Mesosystem. Connections among home, school, and community were weakened and reformed. Parental focus on basic survival needs reduced academic support, yet emergent solidarity, through peer support circles and local elders assisting with makeshift classrooms, helped rebuild essential linkages that buffer against educational discontinuity (Mostafizur Rahman et al., 2023).

Exosystem. Teachers' working conditions were shaped by external institutions that they could not influence. Delayed or uneven relief from the District Education Office and slow NGO deployments constrained access to tents, textbooks, and psychosocial services, undermining teachers' capacity to reopen schools quickly (Government of Balochistan, 2023).

Macrosystem. Broader cultural and socioeconomic norms like conservative gender roles limiting female teachers' mobility and the predominance of local dialects dictated who could teach, how classrooms were reassembled, and which instructional materials were relevant. Balochistan's arid climate and agrarian economy entrenched structural vulnerabilities (Nandy, 2022).

Chronosystem. Unlike rapid-onset disasters, the monsoon-fueled floods represented a slow-onset crisis, extending displacement and recovery over months. This prolonged disruption compounded trauma, eroded institutional memory, and demanded sustained adaptive strategies rather than short-term fixes.

As a result of the Balochistan floods, thousands of people were forced from their homes, many of them relocated to temporary camps, while others went to relatives in urban areas (Kurosaki, 2024; van der Eng, 2024). By mapping the floods onto these ecological layers, the study identifies levers for policy and practice—from reinforcing microsystem supports (targeted psychosocial counseling) to reshaping macrosystem interventions (gender-inclusive disaster planning)—that collectively bolster teacher resilience and educational continuity under climate stress.

Integration with Local Context

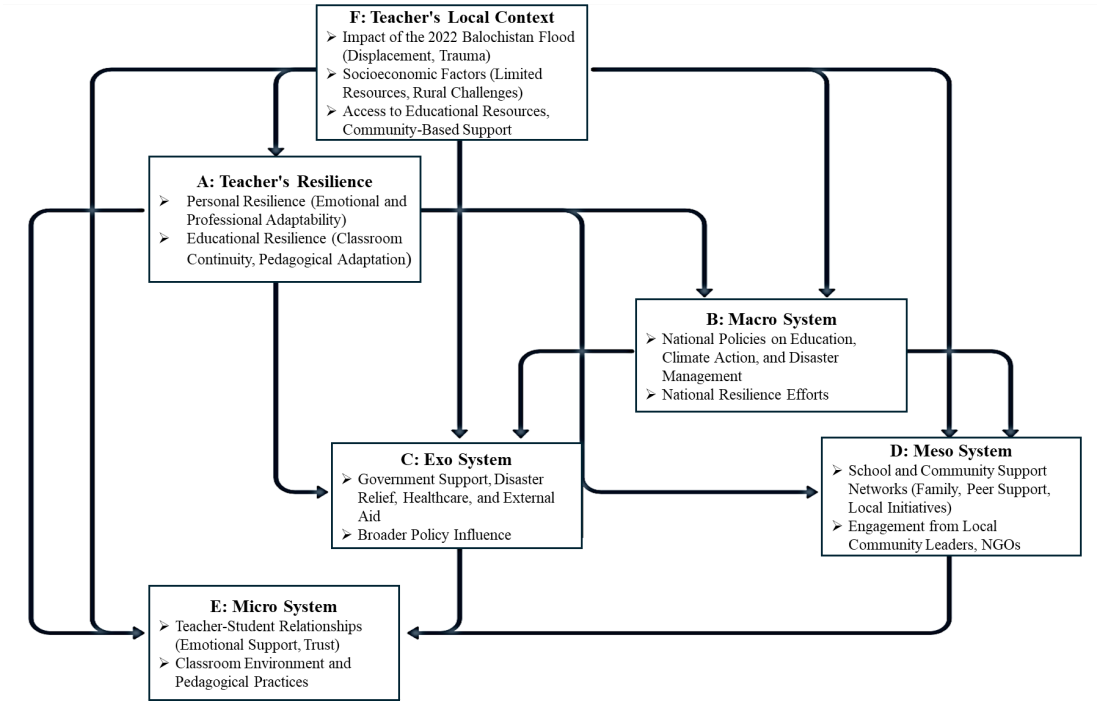
Pakistan's most socioeconomically disadvantaged region, Balochistan, is beset with challenges in a politically unstable, underdeveloped, and climate-vulnerable region (Karim et al., 2024). Because of its arid climate and dependence on agriculture, the region is vulnerable to the effects of climate change (Nandy, 2022). These conditions worsened in 2022 when floods displaced communities and damaged infrastructure, homes, and agricultural lands (Anwana & Owojori, 2023). These challenges are amplified by

climate-induced displacement. Many teachers work in temporary shelters with scarce resources and little support. Balochistan teachers rely on community-based resilience rooted in local networks to be resilient emotionally and pedagogically to support students and adapt teaching strategies(Mostafizur Rahman et al., 2023). Policy interventions and community solidarity aid teachers' resilience.

The conceptual framework presented in Figure 1 draws upon Bronfenbrenner's ecological systems theory to illustrate how various layers of influence shape teacher resilience during climate-induced emergencies. At the macro level, national education and disaster management policies establish the structural boundaries within which teachers operate, influencing available resources and institutional responses. The mesosystem connects schools with community networks, where collaboration with peers, families, and NGOs is crucial in reinforcing emotional and logistical support. The exosystem encompasses broader forces such as government relief programs, healthcare access, and external aid—all of which indirectly impact teachers by shaping the conditions under which they work. The microsystem centers on the immediate classroom environment, where teacher-student relationships and pedagogical strategies are adapted in real time to maintain continuity in learning. These interrelated systems interact with the teacher's local context (e.g., displacement, resource scarcity) to influence how resilience is enacted personally and professionally.

Figure 1

A conceptual framework illustrating the interaction between resilience theory and ecological systems theory in shaping teacher resilience during the Balochistan flood: An exploration of the multi-layered influences on teacher adaptation and educational continuity



This framework highlights how the theories intersect to show the ways in which Balochistan's teachers adapt their roles and interactions within professional and community networks to meet the daily demands of disaster recovery. Socio-political challenges, regional vulnerability to climate change, and the capacity of the existing educational system to respond to displacement are critical factors in determining the nature of resilience strategies teachers adopt. An understanding of these dynamics allows us to analyze how climate-induced displacement and teacher resilience operate within the region as a system and how future disasters can be better managed.

Key Concepts and Operational Definitions

We define key concepts to ensure clarity:

Teacher Resilience. The ability of educators to sustain professional roles, adapt instructional practices, and support students emotionally and academically in the face of personal loss, displacement, and systemic disruption following the Balochistan floods.

Pedagogical Resilience. The teacher resilience measure manifests how the instructors creatively change or innovate instructional practices by giving multi-grade lessons, outdoor teaching, or mobile learning to sustain the attention and learning continuity of students in a crisis (Mansfield et al., 2016).

Adaptive Teaching Strategies. Context-responsive instructional approaches employed by teachers to sustain education during emergencies, including the use of community-gathered materials, improvised curricula, and remote or blended modalities.

Climate-Induced Displacement. Forced or voluntary relocation of individuals and communities due to environmental changes directly linked to climate change, such as extreme flooding, that disrupt daily life, infrastructure, and access to education.

Methodology

Research Design

This study employed a qualitative research methodology to understand teacher resilience in primary school teachers after the Balochistan floods. Qualitative methods are ideal for examining a climate-induced displacement phenomenon as they allow for a nuanced focus on how teachers personally experience and cope using their strategies and resilience mechanisms. These methods allow participants to tell rich stories of adaptation and recovery in their own words. 15 teachers participated in the study—8 through individual semi-structured interviews and 7 through two small focus group discussions (Group 1: 4 rural teachers; Group 2: 3 rural teachers). While the focus groups were smaller than conventional formats, the design was intentional, accommodating travel limitations and connectivity issues in flood-affected areas. This approach allowed for the collection of rich, in-depth data that illuminated how teachers demonstrated

resilience and how community, institutional, and personal factors shaped responses to the floods. Qualitative methods captured socio-cultural dimensions of teacher resilience in the post-disaster context of Balochistan, giving a picture of teachers' challenges and adaptive strategies in Balochistan's schooling environment.

Participants

To capture a rich and nuanced understanding of teacher resilience during the floods, the researchers conducted semi-structured interviews (n=8) and focus groups (n=7). The participants were 15 primary school teachers from urban and rural areas of Balochistan, the Killa Saifullah district, which was severely impacted by the floods. Teachers were identified in collaboration with the District Education Office (DEO) of Killa Saifullah and two NGOs active in flood relief. The DEO provided a list of primary schools affected by the floods. Teachers were selected using purposeful sampling to ensure a diverse representation of experiences across geographic, institutional, and demographic lines. Participants varied in terms of years of teaching experience (ranging from 1 year to over a decade) and degree of flood exposure, including displacement, school closures, and remote teaching conditions. Selection criteria prioritized individuals who worked in schools or communities affected by the floods, allowing for a more focused analysis of how teachers enacted resilience under varying conditions. Urban teachers took part in interviews to capture in-depth personal narratives, while rural teachers were convened in focus groups to accommodate travel/connectivity constraints and to leverage their shared community experiences. Table 1 includes a summary of participants.

Table 1

Summary of participants' experience, location, flood exposure, and data collection method

Participant Code	Years of Experience	Geographic Location	Exposure to Floods	Data Collection Method
P1	2	Urban	Directly impacted	Interview
P2	12	Rural	Displaced, the school closed	Focus Group
P3	5	Urban	Displaced, teaching remotely	Interview
P4	10	Rural	School impacted, no physical classroom	Focus Group
P5	3	Urban	Displaced	Interview
P6	8	Rural	No displacement	Focus Group
P7	7	Rural	Displaced, teaching remotely	Interview

Data Collection

The study employed semi-structured interviews and focus groups for data collection. Researchers conducted semi-structured interviews on a one-on-one basis that allowed teachers to share their personal stories, how they navigated challenges, and their coping strategies. Interviews covered the impact of the floods on teaching, students, infrastructure, teachers' resilience strategies (such as adaptive teaching methods), how the community and institution supported recovery from the disaster, and personal coping mechanisms for dealing with the emotional and psychological stress due to floods. In those cases where face-to-face meetings were not feasible due to geographical or mobility constraints, these interviews were conducted virtually. Interviews were recorded and transcribed with the consent of the participants.

15 teachers took part. 8 in individual interviews and 7 across 2 focus group discussions (a group of 4 rural teachers and a group of 3 urban teachers). The focus groups met at safe, neutral locations or online, depending on participants' availability. Sessions were recorded for thematic analysis.

Recruitment Process

Participants were recruited by contacting schools in Balochistan affected by the floods. The researcher approached teachers via phone or email and explained to them in detail the study's purpose. Local educational institutions or NGOs working in the region provided recruitment assistance. Teachers received no financial incentives. Translators

facilitated interviews and focus groups, ensuring that each participant, rural educators speaking local languages or dialects, could engage in the data collection process.

Data Analysis

The research team analyzed interview and focus group data using thematic analysis to identify patterns of teacher resilience and coping amidst climate-induced displacement. Researchers first familiarized themselves with the data and noted their initial impressions. Using open coding, the research team identified adaptive teaching strategies, psychological resilience, community support, and institutional recovery efforts. They labeled key phrases and responses in the transcripts, which uncovered a broad array of emerging concepts. Initial codes were organized using axial coding to explore relationships between categories, which helped identify broader thematic patterns. Initial codes were clustered into specific themes, which were germane to the teachers' life occurrences, and mapped onto the conceptual framework for the purpose of illustrating how each model explains teachers' adaptive behaviors to the floods.

Ethical Considerations

Ethical approval was obtained from the Southwest University Research Ethics Committee. Written informed consent was secured from participants via signed consent forms outlining the study's purpose, procedures, potential risks, and confidentiality. Participants were informed of their right to ask questions at any point and to withdraw or skip questions without penalty. Data was anonymized, with pseudonyms replacing names to safeguard identities. Given the emotional sensitivity of discussing the floods, participants were reminded they could share only what felt comfortable. Psychological support resources were made available during and after the study.

Findings

Balochistan's primary school teachers demonstrated resilience when faced with the floods, adopting strategies to sustain educational continuity despite multiple challenges. Table 2 shows major themes, sub-themes, and the participant identifiers of those who matched those themes. Thematic analysis produced the categories that represent regular patterns of educational personnel adapting to challenges following the floods.

Table 2

Thematic Summary Table

Theme	Sub-Theme	Participant Codes
Teacher Resilience Strategies	Emotional Support and Psychological Resilience	P1, P6, P8, P9, P11, P13, others (12 total)
	Adaptive Teaching Methods	P3, P5, P7, P9, P11, others (14 total)
	Use of Local Knowledge and Resources	P2, P5, P6, P10, others (9 total)

Challenges Faced by Teachers	Limited Resources	P4, P6, P7, P8, P9, P11, P13
	Psychological Strain and Emotional Exhaustion	P6, P8, P9, P11, P13, others (11 total)
	Cultural Challenges	P1, P2 , P7, P9, P14, P15
Role of Community	Community Solidarity and Support	P2, P5, P8, P10, P13
	Government and NGO Support	P12, P8, P10, P14
Differentiating Factors in Teacher Resilience	Socioeconomic Background	P13 P8, P10, P12
	Language Barriers	P14 P8, P10, P11
	Community Solidarity	P5, P6, P10, P11, P15

Teacher Resilience Strategies

Emotional Support and Psychological Resilience. 12 out of 15 teachers emphasized the importance of emotional support in coping with the psychological toll of the disaster. Teachers reported that they sought emotional support from colleagues, other community members, and family. Teachers who had nothing in common spoke to other educators in support circles, discussing their experiences in an attempt to take some of the burden and emotional stress off their chests and create a sense of solidarity and collective healing. As noted by one teacher, “Talking to my colleagues and knowing we are all going through the same thing made me feel less alone in this feeling” (P1). Another teacher emphasized the importance of relationships with colleagues in supporting emotional healing: “In the past, I used to cry in private, but when my colleagues are at my back, it makes me think once more and be strong enough to continue."(P4)

Adaptive Teaching Methods. Teachers provided examples of how they adapted their teaching methods to accommodate the changing circumstances. When schools were closed temporarily, teachers found creative ways to continue delivering lessons, from using mobile phones for virtual learning to posting online lessons. Some turned to outdoor lessons and taught in community spaces when classrooms became useless. According to one teacher, “The classrooms were flooded, so we started teaching outside, under the trees.”Another teacher said, "To make the best of the situation, “we used our phones to contact students and share lessons.” Another teacher warned, “However, not all had access, but we did what we could do.” (P3)

Use of Local Knowledge and Resources. 9 teachers mentioned using local materials for teaching when conventional materials were unavailable. They used old textbooks, handmade visual aids, or natural elements, like stones and chalk, for writing. In some cases, **community elders** helped to create educational content related to local history and culture, which not only helped teachers teach students but also brought the community together. As one teacher mentioned, "We had to make do with whatever resources we could find—old books, chalk, and even stones for writing practice. The community supported us by gathering any available materials.” (P5)

Challenges Teachers Faced

The teachers were resilient when faced with a myriad of challenges affecting their ability to offer education in the short or long term. They had limited resources, and recovery was psychologically taxing and culturally biased, making it difficult.

Limited Resources. The floods destroyed or damaged schools, leaving classrooms, learning materials, and basic infrastructure unusable. Schools encountered scenarios where the teachers had to deliver lessons without proper textbooks, teaching aids, or sometimes even the most basic supplies such as paper, pens, and chalk. As one teacher said, "We had to teach with no textbooks, and there was barely enough space in the room for the students to sit, but we did the best we could" (P6). Another participant added, "The floods brought down everything" (P4). According to P7, "We had no choice but to be creative with the few materials we had left." These quotes demonstrate the persistent behavior of teachers who made decisions based on resources available amid the crisis. Educators depended mainly on neighborhood help and individual decision-making because they received minimal assistance from institutions. Teachers' capacity to make adjustments without formal materials defines their situational resilience based on informal relationships rather than organization-driven programs. Insufficient availability of necessary resources reveals fundamental structural problems that affect disaster management, particularly in underdeveloped areas such as Balochistan, before the floods.

Psychological Strain and Emotional Exhaustion. Many teachers—11 out of 15 participants—reported living through psychological strain from property loss, displacement, and worrying about the safety of their families. Beyond the difficulty of continuing to teach in the face of the devastation of their communities and the displacement of their students, the emotional toll of what they'd experienced personally weighed heavily. Teachers admitted helplessness in supporting their students, who were traumatized by the floods. A participant explained:

> Given that, at the same time, we worried about our own homes and family, it was hard to focus on teaching. I knew that children needed me; that's why I still went down. 'The emotional stress was overwhelming,' said another teacher. I had to do it, forcing myself to stay engaged with the students even when I did not have the energy. (P8)

Cultural Challenges. Post-disaster, teachers experienced cultural barriers in rural areas where gender roles and local expectations put extra pressure on teachers to function and excel. Women teachers reported facing obstacles in offering emotional support to students due to conservative norms that negatively impacted their mobility and interactions with boys. A woman teacher reflected, "As a woman, it was hard to reach out to male students who were also displaced. The cultural norms often hindered the support we could give." (P10)

Role of Community and Policy Support

Teachers successfully maintained their educational activities during flood recovery because of community support, together with policy intervention. Local community support and policy guidance played essential roles in teachers maintaining their positions during the educational process.

Community Solidarity and Support. Several teachers cited the local community as very important to their resilience. Participants P2, P5, P8, P10, and P11 mentioned community members stepping in to provide emotional encouragement or material aid regarding their children. The teachers said that the solidarity of the local community balances their resilience. The community came together on many occasions to provide material support through donations of food, clothing, and school supplies. Communities helped teachers and students rebuild the makeshift schools in safer areas, and in some locations, local elders and youth filled in to help deliver lessons where teachers could not. “Whenever we needed anything, someone was always there to help—to rebuild the classroom or to help the children.” (P11)

Government and NGO Support. Teachers emphasized in their responses that while community support was very important to sustaining their resilience, governmental and NGO support are needed to ensure that teachers and education employees in these contexts receive emotional support in addition to material support. Local government agencies and NGOs provided schools with emergency relief through tents, teaching materials, and psychological resources for teachers. Teachers complained that they were not getting enough from the official responses fast enough. "They were a part of it, the NGOs helped, but it was too slow," said one teacher.“It did not get to us till many schools were closed for weeks.” (P12)

Differentiating Factors in Teacher Resilience

The study revealed that socio-economic and cultural factors affected teachers’ responses to challenges and strategies for educational continuity as they coped with the floods.

Socioeconomic Background. Teachers from higher socio-economic backgrounds in the study described greater resources and more support, personally and professionally, enabling them to recover more quickly. Teachers from lower-income families experienced greater financial pressures and had fewer resources with which to adapt. As a teacher reflected, “We were stranded to just get by, 'but teachers from wealthier families could rebuild their homes and schools faster.” (P13)

Language Barriers. In the communities where local languages and dialects are the predominant languages, teachers who could speak these languages had greater interactions with students, and teaching in the aftermath of the floods was not a challenge. Teachers who were not fluent in the local dialects had difficulties reaching all students and giving them enough support. A teacher said that:

> Being able to speak the language of the local people was crucial. I was able to easily understand the children's needs and be able to help them process their emotions. Such naming was much harder for teachers who did not speak the language. (P14)

Community Solidarity. The extent of community solidarity is an important factor that participants described as affecting teacher resilience. In cohesive communities with strong support networks, teachers indicated higher resilience and a stronger collective responsibility. Another teacher said, "in our area, we all worked together, so it was not just the teachers who were resilient; it was the whole community." (P15)

This study's findings indicate that the floods demonstrated the resilience of primary school teachers. Teachers used several coping strategies, from emotional support and adaptive teaching methods to community-based resources. The challenge of constrained resources, psychological strain, and cultural barriers made teachers poorly suited to continue teaching effectively. It was the role of community support that allowed teachers to maintain educational continuity. Teachers' resilience strategies were shaped by their socioeconomic background and language barriers, along with community solidarity. These contributions provide insights into how trauma, climate-induced displacement, and educational continuity interact to impact teacher and student achievement in disaster-prone regions. This can help inform future disaster recovery and educational policy in places that undergo similar tragedies.

Discussion

This study about teacher resilience after the 2022 Balochistan floods yields an understanding of the disruption to teachers due to a disaster. Concerning resilience theory and climate-induced displacement, the study finds that teacher resilience is a multifaceted phenomenon including emotional, cognitive, and social dimensions that sustain educational continuity in the face of adversity. Existing literature on resilience supports these findings (Ghosh & Orchiston, 2022; Tong, 2021; Yusriadi & Kaslin, 2025).

Emotional resilience through community support and coping strategies was vital for teachers to continue their jobs. This is consistent with resilience in education theory, which assumes resilience is not an individualist attribute and that educators can be aided by strong social relationships (Carmen et al., 2022). Teachers shifted their teaching methods towards adaptations or adaptive teaching methods. They used mobile learning and outdoor classrooms, supporting prior studies about how teachers innovatively use resources available to create alternative educational environments (Vidergor, 2021).

The study affirms much of the existing literature, adding nuances particular to the case of climate-induced displacement. This study finds that while climate-induced displacement has been well-studied among refugee and migrant populations (Boltz et al., 2021), the impact of displacement on local communities, including teachers in a state

of calamity, remains under-researched. In Balochistan, teachers not only lost homes and property but also witnessed their entire communities fleeing, deepening their sense of loss and uncertainty. When teachers talk about the emotional burden of post-disaster education, this implies that resilience in post-disaster education goes beyond logistical adaptation and has a lot to do with emotional recovery.

The findings show the intersectionality of resilience for teachers whose socioeconomic status, language proficiency, and gender roles impacted their ability to respond to the crisis. This is congruent with recent research in disaster resilience that demonstrates that it is not monolithic but, rather, contextual and dependent on social and cultural factors (Hill et al., 2023). Teachers who came from wealthier backgrounds or who spoke the local languages had an easier time overcoming distinct challenges, as opposed to others who struggled to keep their professional roles.

Contextualizing Teacher Resilience

Balochistan teachers show resilience comparable to teacher resilience in other disaster-prone areas worldwide, though it depends on whether the climate-induced disaster is a one-time event or slow-onset. The Balochistan case deals with climate-induced displacement instead of an isolated one-time event, such as a hurricane or earthquake. Unlike rapid-onset disasters, climate-induced displacement, due to slow-onset events (droughts, floods), is a long-term problem for educators, specifically recovery (Azadi et al., 2022). Rapid-onset climate-induced displacement refers to sudden disasters (e.g., hurricanes, floods) that force people to flee immediately, causing short-term, often temporary movement back or elsewhere (Almulhim et al., 2024). Slow-onset events (e.g., prolonged droughts, desertification, sea-level rise) gradually erode livelihoods and habitability, ultimately compelling communities to relocate after a longer period of deteriorating conditions. Rapid-onset disasters trigger immediate displacement, whereas slow-onset changes lead to more gradual, long-term displacement as stresses accumulate (Richards & Bradshaw, 2017; Rigaud et al., 2018).

The mass displacement following Hurricane Katrina in 2005, which caused over a million Gulf Coast residents to flee from their homes, has been described as the largest climate-induced displacement event in the United States (U.S.). This illustrates how an extreme weather event exacerbated by climate factors can uproot entire communities (Baussan, 2015). After Hurricane Katrina, it was the teachers in New Orleans who showed their resilience through community solidarity and adaptive teaching methods (Yarmoham et al., 2025). Like the teachers in Balochistan, New Orleans teachers depended on each other and their communities to rebuild education after schools were obliterated. In contrast with New Orleans, extensive displacement of teachers has been a prolonged problem in Balochistan, as most of the students, as well as the teachers, were displaced for several years, which made it harder to accommodate education with any stability and permanence. The emotional and psychological strain on teachers was considerable and was more marked in slow-onset disasters than in sudden catastrophes.

Teachers' responses drew on adaptive learning techniques and community engagement (Hanne, 2020) in Haiti and the Philippines, where displacement has been caused by climate change and disasters. Distinct linguistic diversity and rooted cultural norms in Balochistan formed the basis of the resilience strategies that teachers adopted. Local language proficiency and gender norms were felt in the unique ways teachers related to students and communities, as has not been the case in other contexts. While such factors are present in other disaster-affected regions, their manifestation in Balochistan shaped distinct resilience strategies that may not be directly comparable to other settings.

Policy Implications

The emotional and psychological needs of teachers in disaster-prone areas are relevant to respond to the effects of climate change. Educational policymakers should prioritize these needs. Teacher resilience should be included within pre-service training and ongoing professional development programs that speak to mental health support, emotional coping strategies, and community involvement.

Teacher training programs must provide teachers with strategies to help them build their resilience and to help their students during times of crisis. Psychological resilience training should be incorporated into teacher education programs to assist educators in managing the emotional impact of disasters while still effectively doing the jobs they are employed to do. As one teacher said, "We were not trained to handle these kinds of situations. To handle the trauma, we need more psychological support" (P10). These results imply that future teacher training should emphasize preparedness for disaster and emotional intelligence.

Local and national policy support should improve teacher resources during and after disasters. This covers helping teachers access teaching materials, alternative learning platforms, and financial support. Governments should collaborate with NGOs and local communities to create emotional support networks to ease teachers' workloads.

Disaster preparedness programs should extend beyond infrastructure. We recommend that policymakers create complete disaster plans discussing provisions for teacher welfare, training in adaptive teaching methods, and emotional recovery. The long-term effectiveness of education in disaster-prone regions would depend on policy commitment to teacher well-being.

Limitations

Multiple limitations affect this study's understanding of teacher resilience during climate-induced displacement. The research sample consisted of 15 educators who worked in urban and rural schools of Balochistan, although the participant selection was restricted to one district. These narrow geographical research boundaries might not provide a comprehensive understanding of how teachers experience displacement in different regions of the province or the country. This study does not capture possible

effects of divergent district-level institutional support, infrastructure development, and community involvement because these evaluations are unknown and not quantified. The research findings require cautious interpretation because they only represent an initial stage from which studies across different contexts should build.

While the study's qualitative design is strong in capturing individual narratives and personal experiences, it is limited in its ability to generalize the findings. Future research using a mixed-methods approach that could provide qualitative insight and quantitative data could provide a larger view of this phenomenon of teacher resilience. This study is limited to the period after the 2022 floods hit. The long-term effects on teachers' professional development and the rebuilding of educational systems were inaccessible. More research is needed to better understand the longitudinal effects of disasters on teacher resilience and education continuity, including how teachers sustain resilient responses over time as they endure successive shocks.

Conclusion

This research explores primary school teachers' resilience to respond to floods and their experiences of climate-induced displacement. Teachers demonstrated resilience through adaptive teaching, emotional support, and community networks. Teachers dealt with psychological strain, lack of resources, and interruptions in their personal lives while adapting to mobile classrooms and outdoor education. The challenges teachers faced in implementing technology depended on the teacher's gender, socioeconomic status, and language proficiency, with wealthier and more connected language teachers facing less barriers. Women teachers and teachers from marginalized backgrounds faced the biggest challenges due to cultural taboos and social norms.

We propose practical recommendations to improve teacher resilience in similar contexts. Importantly, to proactively prepare teachers for the psychological, emotional, and instructional challenges they may face while participating in disaster response and recovery efforts, provide teacher support as part of disaster preparedness, provide emotional and psychological assistance to teachers, offer flexible/playback instructional resources, and financial support. Teachers need to be trained in psychological resilience through professional development as well, ideally through workshops and support sessions facilitated by educational psychologists, school counselors, or trained mental health professionals in collaboration with local education authorities or NGOs.

More research is needed on gender-specific resilience and long-term recovery strategies for teachers in post-disaster settings. Exploring opportunities to leverage technology to support teachers' recovery may afford sustainable education solutions in disaster-prone areas. This study emphasizes the need to provide teachers with resources and emotional support to ensure educational continuity amidst disasters and displacement.

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Migration, Climate, and Education: Proposing Human Rights-Based Education for Internally Displaced Learners in Lower- and Middle-Income Countries

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The growing impacts of climate change are forcing families in low- and middle-income countries to migrate to urban areas, resulting in widespread internal displacement. Despite the significant disruptions this causes to children's education, its educational consequences remain underexplored in climate change research. This study addresses the gap by adopting a Human rights-based approach (HRBA) to education and integrating insights from the Education in Emergencies framework while examining the impact of climate-induced displacement on education. Through a literature review of academic and policy documents, the research examines educational vulnerabilities of internally climate-displaced learners, including restricted access to schooling, declines in academic performance, and difficulties adapting to new learning environments. The challenges are pronounced for girls, reinforcing pre-existing gender disparities in education. Based on the findings, the study proposes targeted policy interventions, including climate-responsive education frameworks and economic protection measures for affected households.

Keywords: Climate change, Displacement, Education in Emergencies, educational policies, Global South, Human rights-based education, International and Comparative Education.

Introduction

The detrimental effects of climate change and natural disasters have forced approximately 21 million global displacements annually since 2008, leaving their homelands and migrating to larger urban centers in search of livelihoods (Bellizzi et al., 2023). These individuals, referred to as internally displaced persons (IDPs), are involuntarily uprooted from their homes due to the impacts of conflicts or climate crises (Internal Displacement Monitoring Center [IDMC], 2019). The situation is severe in lower- and middle-income countries (LMICs), characterized by limited financial resources, weaker infrastructure, and reduced access to social services compared to high-income nations (IDMC, 2019). LMICs experience heightened vulnerability to climate change effects, as they struggle to adapt to or recover from disasters (Anderson, 2023). A deficiency in adaptive capacity exacerbates existing socio-economic challenges and leaves communities increasingly exposed to the long-term impacts of climate change, including extreme weather events, rising sea levels, and agricultural disruptions. These environmental challenges undermine the ability of displaced populations to rebuild their lives and establish sustainable livelihoods in new locations, creating a cycle of vulnerability that is difficult to break without targeted interventions and support systems (Anderson, 2023; Kousky, 2016).

Children and young individuals, including displaced students, are at risk of losing more than just their homes and shelters; they face the potential loss of access to education, training, and opportunities that are pivotal to shaping their future (Chand et al., 2023). While numerous studies have underscored the impact of climate change on displaced families and children, affecting their health, safety, employment, finances, and emotional well-being, the United Nations Children's Fund (UNICEF) (2019) confirmed that educational needs have been overlooked in climate change dialogues, and the inclusion of education systems in these discussions has been peripheral. There is a research gap in comprehending education-related facets for children and youth within climate-displaced households, leaving their challenges in accessing quality education, academic performance, and inclusiveness unexplored (International Committee of the Red Cross [ICRC], 2018; IDMC, 2019; Kousky, 2016; Nordstrom & Cotton, 2020; UNICEF, 2019; United Nations Educational, Scientific and Cultural Organization [UNESCO], 2020; Vaughter et al., 2023).

My study seeks to bridge this research gap by exploring the question: How does climate change affect internally displaced learners in LMICs? My goal is to investigate the effects of climate on the education of K-12 displaced learners before and after they leave their homelands to assess the repercussions at the ends of their journey and to gain a comprehensive understanding of the educational disruptions and adaptations these learners undergo. This research ventures into an underexplored realm by bridging the gap concerning educational challenges faced by climate-displaced learners. It also yields valuable insights to inform evidence-based policies aligned with Sustainable Development Goal 4 (quality education), which aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all by 2030. These policies can guide the efforts of policymakers, educational institutions, and development organizations as they tailor interventions to address the unique challenges these learners encounter in LMICs.

This paper begins by establishing a conceptual framework, followed by an in-depth analysis of the distinct repercussions of climate change on the education of displaced learners in their original and relocated settings. This comparative exploration aims to shed light on the additional challenges that arise as displaced learners navigate transitions to new environments. A dedicated section examines gender inequities in the educational experiences of male and female displaced learners, along with the structural and cultural factors contributing to these disparities. This is followed by a discussion section that synthesizes key insights from the analysis to explore broader implications for policy and practice. It will present a set of recommendations to mitigate the impacts of climate change on the education of displaced students. The conclusion succinctly summarizes the key findings.

Conceptual Framework

The identification of an appropriate theoretical or conceptual framework for this topic presents several challenges. First, the impact of climate change on the education of displaced learners is a relatively new and continually evolving field. Consequently, it is difficult to identify well-established theoretical frameworks that

comprehensively address all of the intricacies of this issue. Climate change is a protracted process that does not always unfold rapidly, comprised only of sudden events. Climate change occurs over extended periods, leaving subtle and enduring effects in its wake. Its impact on education may manifest over years or even decades (Kagawa, 2005). Current research and frameworks on climate change primarily concentrate on immediate or direct coping strategies, with little exploration of the indirect or chronic effects of climate change. This can pose challenges for studies that aim to understand the holistic impact of climate change on education.

In this context, for a comprehensive understanding of the research topic, this study employs a blended approach. It adopts an integrated theoretical framework that combines the Human Rights-Based Approach (HRBA) to education with insights from Education in Emergencies (EiE) research. This integration addresses the complex challenges of studying the impact of climate change on the education of displaced learners, given the field's evolving nature and the varied temporal dimensions of climate-related disruptions.

The HRBA to education, derived from the principles of the Universal Declaration of Human Rights 1948, which asserts the right to education for everyone (UNESCO, 2020), highlights the need for a comprehensive approach to education. According to UNICEF and UNESCO (2007), HRBA encompasses three interlinked and interdependent dimensions, emphasizing that the realization of human rights to education hinges on addressing all three components. Firstly, it upholds the right to education access as the cornerstone of equal opportunity, ensuring that education is available, accessible, and inclusive for all children, fostering regular attendance and reducing dropout rates. Secondly, the framework champions the right to quality education, enabling learners to unlock their full potential, seize employment opportunities, and cultivate essential life skills. This requires an education that is relevant and offers a comprehensive curriculum that empowers learners by nurturing life skills, learning capacities, self-esteem, and self-confidence. Thirdly, it advocates an environment within the learning space that upholds respect and dignity. This means delivering education in a manner consistent with human rights, affording every child equal respect, opportunities for meaningful participation, and ensuring a climate free from discrimination (UNICEF & UNESCO, 2007). HRBA guides my analysis, focusing on the principles of equity, non-discrimination, and the promotion of human rights, providing a comprehensive understanding of challenges and opportunities faced by displaced learners in their educational journeys.

The HRBA framework is valuable for examining systemic issues such as educational exclusion, quality deficits, and gender inequality, which intensify during crises (Tuparevska, 2022). This approach is widely used in research on displaced learners affected by conflict and violence, underscoring that while education is a fundamental human right and a critical need during displacement, it is deprioritized in favor of resettlement and safety concerns (UNICEF & UNESCO, 2007). However, this framework primarily focuses on immediate and direct interventions, such as restoring education for children in emergencies or addressing legal barriers to formal education in host countries (Tomaševski, 2004).

EiE research complements the HRBA framework by providing crucial insights into both acute and chronic emergency contexts. One notable advantage of referencing works in this field is their clarification of the term 'emergency' in natural crises and environmental contexts, and their insights into how such situations impact educational outcomes (Burde et al., 2016). Accordingly, EiE research encompasses not only immediate emergency cases, such as wars, conflicts, floods, and earthquakes, but also accounts for silent or chronic emergencies, such as persistent poverty and complex emergencies, which involve a combination of immediate and chronic impacts (Chand et al., 2023; Kagawa, 2005).

The integration of HRBA and EiE approaches creates a robust analytical framework that captures the immediate and long-term impacts of climate change on displaced learners' education. This combined framework enables examination of:

- Direct impacts from sudden climate events on educational access and quality.
- Indirect effects through household disruptions, including economic hardship and displacement.
- Long-term consequences for educational environments and learning opportunities.
- Systemic challenges in ensuring educational rights during immediate and chronic emergencies.

Methodology

The study centered on a literature review to examine how climate-induced displacement affects learners' access to and quality of education, along with the effects on the learners' educational environments. To ensure breadth and depth in data collection, I deliberately expanded my search beyond traditional academic databases to include grey literature from policy papers, reports from international organizations, governmental publications, and media articles. I employed a dual-method approach to literature identification: the snowball method, wherein I traced reference lists from key documents to discover additional relevant sources; and direct database searches through Google Scholar and other databases such as Web of Science and Scopus. To mitigate potential biases inherent in the snowball method and ensure comprehensive coverage, I systematically varied search terms and used diverse keyword combinations such as 'displacement,' 'internal displacement,' 'migration,' 'education,' 'climate change impacts,' 'natural disasters,' and 'displaced students.' The search process concluded when searches yielded mostly redundant information, indicating saturation.

From an initial pool of over 100 documents, I refined the selection to 73 based on three inclusion criteria: topic relevance, prioritizing studies that integrated multiple aspects of the research focus (migration, displacement, education, and climate change) while eliminating redundancy; geographic relevance, emphasizing low- and

middle-income countries; and language accessibility, restricting the review to English-language publications.

For the analysis, I identified recurring themes, evaluated methodological approaches, assessed theoretical frameworks, and critically examined research findings to synthesize the current state of knowledge on the educational impact of climate change on internally displaced populations. I considered the immediate and long-term effectswere considered across each dimension, offering a nuanced understanding of the challenges displaced learners face.

Findings

The impacts of climate change are complex and multifaceted, influencing education through various channels such as displacement, resource scarcity, and health consequences (UNESCO, 2020). These effects encompass direct and indirect impacts and simultaneously extend into various societal domains beyond education. It is crucial to acknowledge that disasters unfold at different paces; rapid-onset disasters occur almost instantly, while slow-onset disasters can be predicted in advance and unfold over months or even years. Rapid-onset disasters primarily cause immediate physical impacts, whereas slow-onset disasters generate crises through economic and social repercussions (Randall, 2018). Although types of disasters force people to relocate for survival, each case has different effects on the education of their children. Sudden disasters typically lead to involuntary movements, with little to no time to make preparations for their children's education. Those affected by slow-onset disasters may have more time to prepare psychologically, procedurally, and financially for the transition in their children's education (UNESCO, 2020). This complexity poses a challenge in adequately addressing all dimensions of the issue.

The findings reveal that climate change restricts access to education and undermines its quality for displaced learners. Learning environments in new locations may lack cultural diversity and inclusivity, creating additional barriers to their educational experiences and performance. These difficulties are exacerbated for girls, who face heightened challenges due to persistent gender inequalities.

Educational Barriers and Academic Struggles in Learners' Homelands

Climate change affects learners' educational access and performance through immediate disruptions and long-term challenges. This impact manifests through 3 key mechanisms: direct physical barriers, socioeconomic pressures, and environmental conditions affecting learning capacity.

Physical access disruptions create the most immediate barriers to education. When rapid-onset disasters such as tropical cyclones or floods strike, they destroy school buildings or transform them into emergency shelters, causing learners to face temporary or sometimes permanent interruption to their schooling (Mooney & French, 2005; Randell, 2019). These disruptions extend beyond school buildings to include damaged transport infrastructure, creating additional obstacles that compromise educational access (Anderson, 2019; Kousky, 2016; Sims, 2021).

Slow-onset disasters such as droughts or salinization cause climate-related economic pressure, creating significant barriers to education, particularly for agricultural households affected by these events with reduced income and food security (ICRC, 2018; IDMC, 2019). Many families find themselves unable to pay school fees, leading children to withdraw from school to contribute to household income. Examples of this can be drawn from ongoing climate disasters in Iraq, Cambodia, China, and Sub-Saharan countries, as a few examples (ICRC, 2018; IDMC, 2019; UNICEF UK, 2017; Weng et al., 2020). Some families are forced to migrate in search of better opportunities, disrupting their children's education (Anderson, 2019; Chuang et al., 2018; Kousky, 2016). During severe droughts, girls miss school to collect water or face early marriage as families cope with financial pressures resulting from the droughts (Randell, 2019). In extreme cases, families must choose between providing food or education for their children (Mooney & French, 2005).

Research reveals complex relationships between climate conditions and educational outcomes that can develop for years. Higher-than-usual temperatures in Southeast Asia correlate with fewer years of schooling (Randell, 2019), and studies show that each 1°F increase in school-year temperature reduces learning by one percent, with a greater impact on low-income and minority learners (Goodman et al., 2018). Increased rainfall during agricultural seasons and cooler temperatures in early childhood positively correlate with educational achievements in later years of a learner's life (Maccini & Yang, 2009; Randell & Gray, 2016).

Numerous studies have indicated that weather phenomena tend to correlate with school attendance. Randell (2019) found that in Southeast Asia, a region historically characterized by hot and humid conditions, experiencing temperatures hotter than usual is associated with fewer years of schooling compared to other regions. Mottaleb et al. (2015) (as cited in Parkhurst, 2022) indicated that the need to rebuild farms after cyclonic disasters in Bangladesh leads parents to pull boys out of school to assist with reconstruction. Studies have revealed that increased rainfall during the main agricultural season, along with cooler springs and summers during early childhood, are positively correlated with completing more grades of schooling (Maccini & Yang, 2009; Randell & Gray, 2016). These findings are somewhat consistent with other studies that have shown school attendance rates in certain countries rising during extreme periods of natural disasters, with girls exhibiting more consistent attendance than boys (Shah & Steinberg, 2017; Nordstrom & Cotton, 2020). One notable hypothesis is that during such extreme circumstances, household farming activities are disrupted, freeing children from agricultural responsibilities and allowing them additional time to attend school (Nordstrom & Cotton, 2020).

Despite the mixed findings regarding attendance rates, there is consistently compelling evidence suggesting that academic performance is not necessarily improved during disasters (Anderson, 2019). Increased time spent in school does not always equate to enhanced learning outcomes (Anderson, 2019; Weng et al., 2009). Economic hardship and malnutrition impair cognitive function, while psychological trauma from natural disasters affects learning capacity (Randell, 2019; Sims, 2021). Learners in drought-affected areas consistently score approximately 4 percentage

points lower than their peers in unaffected regions (Nordstrom & Cotton, 2020). The impact of these challenges is evident in academic performance measurements. The long-term developmental impacts of climate-related challenges during early childhood can have lasting effects on educational outcomes. Research demonstrates that early-life flooding increases vulnerability to waterborne diseases, while low birth weight and childhood undernutrition correlate with poorer cognitive development (Kousky, 2016; Weng et al., 2020). Early effects can shape a child's education, creating disparities that may persist well into their academic future (Victora et al., 2008).

These interconnected challenges highlight the complex relationship between climate change and education, demonstrating how environmental disruptions create immediate and long-lasting barriers to learning and academic achievement. These difficulties are pronounced in learners' home regions, where the direct effects of climate change are evident. When learners are displaced due to the climate crisis, they encounter additional hurdles in their new environments (including exposure to climate change effects), compounding the barriers to their educational opportunities.

Additional Challenges in New Destinations

Compared to their homelands, displaced learners face additional barriers when seeking education in new environments, ranging from financial difficulties to bureaucratic hurdles, resource constraints, discrimination, and limited access to alternative learning solutions. These challenges, shaped by systemic inadequacies and the broader socio-economic impact of climate change, can significantly hinder their educational access, quality, and overall learning experience.

Financial barriers are among the most immediate obstacles displaced learners encounter when the education system in the host country involves direct or indirect costs that are difficult to meet. Displacement results in loss of livelihood and income, leaving many families struggling to afford school fees, classroom supplies, and other educational expenses. In this context, climate change exacerbates poverty, intensifying the financial burden on displaced families (Pachauri et al., 2015). Under these circumstances, children and adolescents may prioritize work over schooling, whether due to economic necessity or pressure to send money home to support their families (UNICEF, 2017).

Administrative barriers within host countries can make it difficult for displaced learners to enroll in and attend school. In countries like Vietnam and China, internal household registration systems (e.g., *hukou*) create legal and logistical obstacles for students relocating within their own country (Garcia, 2021; Li & Zhang, 2023). Although these learners technically retain their right to education, the practical implementation of this right is obstructed by rigid administrative frameworks. While internal displacement may allow learners to continue their education in a familiar linguistic and cultural setting, regional disparities in curricula and educational policies can still pose significant challenges (UNESCO, 2019).

Discrimination and social exclusion present additional barriers to displaced learners' successful integration into their new educational environments. While migration can be a crucial adaptation strategy for improving educational and

economic prospects, displaced students frequently encounter racial, religious, and ethnic discrimination in host communities (UNICEF UK, 2017). Cultural and linguistic differences, unfamiliar school environments, and exclusionary practices can result in bullying, diminished self-esteem, and even segregated education (IDMC, 2019; Mooney & French, 2005). These experiences can discourage parents from enrolling their children in school, negatively impacting educational attainment (Şirin & Rogers-Sirin, 2015). Displaced families are underrepresented in school decision-making processes, limiting their ability to advocate for inclusive policies and programs (IDMC, 2019). Exclusion and discrimination can hinder students' ability to engage with classroom material, perform academically, and develop a sense of belonging within the school environment (Şirin & Rogers-Sirin, 2015).

Distance learning and alternative education solutions, introduced as a means to ensure educational continuity, present their own set of challenges. Many governments and international organizations have promoted online learning platforms as a solution for displaced learners. However, access to technology and reliable internet connectivity remains a significant barrier, particularly in displacement settings where mobile phones, computers, and digital resources are scarce (UNESCO, 2020). While online learning content has expanded across multiple countries, these programs are not designed for long-term displacement scenarios (Vaughter et al., 2023). Issues such as inadequate teacher training, uncertified examinations, and unstable funding undermine the effectiveness of distance education (Dryden-Peterson, 2011). Online education reduces opportunities for social interaction, which is a key factor in helping displaced learners integrate into new environments and build supportive peer networks (Joosten & Cusatis, 2020). The lower quality and accessibility of these alternative education models risk limiting the academic potential of displaced students and contradict the HRBA to education, which advocates for equitable access to quality learning opportunities.

While schools and local governments are expected to establish support systems for displaced learners, their **lack of preparedness** significantly limits their ability to provide effective interventions, particularly in immediate emergency contexts such as floods, earthquakes, typhoons, or hurricanes. Anderson (2023) points out that many LMICs face severe financial constraints, making it difficult to invest in infrastructure upgrades, teacher training, or curriculum adjustments that could accommodate displaced students more effectively.

The lack of effective governance and data management systems complicates efforts to track and support displaced learners. Many LIMCs struggle to collect reliable data on displaced students, making it difficult to assess educational outcomes and identify students in need of support (Dryden-Peterson, 2017; Interagency Network for Education in Emergencies [INEE], 2020). Without comprehensive tracking mechanisms, interventions remain fragmented and reactive rather than proactive, limiting their long-term effectiveness.

The challenges faced by displaced learners in their original homelands and new environments go beyond logistical and administrative barriers – they have profound

effects on students' well-being, which in turn influences their ability to succeed in school (UNICEF UK, 2017). Without adequate psychosocial support and access to stable learning environments, these compounded challenges can undermine students' academic engagement and overall development (Burke et al., 2018; Kousky, 2016). As the following section will explore, the intersection of displacement, well-being, and education underscores the urgent need for holistic interventions that address immediate survival needs and long-term educational resilience.

Well-being of Affected Learners

Research reveals that children and youth are at a heightened risk of experiencing poor health outcomes related to climate change due to their greater dependency on others for survival and well-being, ongoing development of their physiological defense systems, and the longer duration over which they will experience the effects of climate change compared to older generations (Augustinavicius et al., 2021). Many children affected by climate or natural crises have been documented to experience serious psychological trauma, jeopardizing their schooling and impacting their concentration and performance (iDMC, 2019). Three years after Hurricane Katrina in the United States, more than one-third of the children who had been displaced or severely affected by the hurricane were at least one year behind in school, which was double the pre-storm rate. This was attributed to issues related to behavior and negative impacts on attendance, suspension, and expulsion (UNICEF UK, 2017).

Related events, such as the loss of a parent (or parents), the loss of home and cherished objects, evacuation from a community, or the disruption of connections to civic institutions like schools and medical services can have detrimental effects on a child's physical, mental, and social development (Burke et al., 2018). Moreover, there is evidence indicating that children from low-income families, who are already vulnerable to insufficient social and educational development, are disproportionately affected by disasters compared to adults (Abramson et al., 2010; Anderson, 2019). Boyden and Mann (2005), in their research on Tamil children who were displaced due to armed conflicts or natural disasters, revealed the children's impaired social and cognitive functioning, expressed by antisocial behavior and an inability to show affection, besides long-term anxieties and fears.

Throughout the lifespan, climate change-related stressors have been shown to affect neurodevelopment and mental health. Children under the age of 10 born with low birth weights typically exhibit cognitive, IQ, and motor scores approximately 5 points lower than those with normal birth weights. This risk of cognitive and motor deficits due to low birth weight persists from early childhood into adolescence (Weng et al., 2020). In this way, child development, encompassing physical and neurological development, as well as subsequent educational progress, is significantly influenced by climate change. Factors such as food and water scarcity, the spread of infectious diseases, toxic stress and early childhood adversity, poverty, disrupted education, and air pollution all contribute to this impact (Anderko et al., 2020; Save the Children, 2007, 2009).

Climate change can indirectly affect the learners' mental health. A study involving 400 children from 10 rural communities in China who were not living with their parents as they migrated for their livelihoods revealed an increase in stress and workload, leading to depression. Girls left behind are particularly vulnerable, facing a greater psychological burden due to heavier workloads (UNESCO, 2019). Specifically, the absence of mothers has been shown to have a negative correlation with children's overall well-being, significantly affecting their educational outcomes. Research indicates that Filipino children are 15 percent more likely to struggle in school when their mothers migrate abroad (Cortés, 2015).

Psychological challenges intersect with pre-existing social vulnerabilities, creating compounded barriers for specific demographic groups (Chuang et al., 2018). Girls, in particular, face a distinct set of obstacles when climate displacement disrupts their education, as gender-based inequalities become more pronounced in crises. Their unique experiences reveal how climate-induced displacement can exacerbate existing educational disparities and create new challenges that require targeted interventions.

Girls' Education and Climate Change Impacts

Girls face heightened educational barriers due to climate-related factors, as climate change amplifies pre-existing gender disparities through entrenched socioeconomic inequalities. These challenges are driven by climate-induced disruptions and reinforced by deep-seated social norms, power imbalances, and discriminatory practices that disproportionately affect girls' education. The intersection of climate vulnerability and gender inequality exacerbates education exclusion, leading to long-term setbacks in gender equity and economic opportunities (Chigwanda, 2016; INEE, 2022; Kwauk et al., 2019; Plan International, 2019).

Several factors contribute to this pattern, including an increase in household chores and responsibilities, prioritizing the education of male siblings, and difficulties in managing menstrual hygiene (Chigwanda, 2016; Sims, 2021). Rao and colleagues (2019) indicate that "across contexts, agriculture is feminized in terms of women's labor contribution" (p. 20). A World Health Organization (WHO) (2019) report highlights that in 53 out of 73 surveyed countries, over half of households without on-premises water access rely on women to collect water, with 73.5 percent assigning this responsibility to women. Low-income women and female-headed households have frequently been identified as among the most vulnerable to climate change, facing specific forms of inequality such as limited access to formal education (Rao et al., 2019).

During displacement, educational access highlights persistent gender biases that manifest through economic and cultural mechanisms. When migrant families face financial constraints, they systematically prioritize boys' education across different contexts (UNESCO, 2019). In South Africa, migrant families' exclusion from local fee exemption programs leads to boys receiving educational priority. Chinese migrant parents exhibit similar patterns, investing more resources in their sons' education through enhanced documentation efforts and a willingness to pay for distant state schools, while their daughters typically attend lower-quality migrant schools

(UNESCO, 2019). The extent of this bias is quantifiably demonstrated in Cambodia, where 75 percent of surveyed households (from a sample of 600) indicated they would withdraw their daughters rather than their sons when facing financial constraints (Save the Children, 2016; UNICEF UK, 2017).

Parental migration creates an additional layer of gender-specific educational barriers through two mechanisms. When parents migrate, older girls assume expanded household responsibilities, a pattern documented across Mexico, China, and Kyrgyzstan (Kwauk & Braga, 2017). The educational impact is significant: in Chinese migrant households without remittances, girls' high school attendance drops to 20 percent compared to 29.76 percent for boys (Hu, 2011). Cultural factors compound these challenges, as evidenced in Mali, where internally displaced adolescent girls discontinue education due to concerns about male interactions and domestic responsibilities (UNESCO, 2019). These intersecting economic and cultural barriers not only reflect historic gender norms but actively reinforce them, creating long-term economic disparities through reduced educational access (Sims, 2021).

Once girls discontinue their education, they have a limited timeframe to re-enter school before being compelled to pursue alternative paths, including early marriage or migration for work (Polak, 2010). Consequently, the impacts of climate change are not gender-neutral; women and men encounter the consequences of exposure to climate change and environmental degradation differently (Kwauk et al., 2019; UNDP, 2016). In certain contexts, climate change and environmental degradation worsen gender inequalities, affecting the capacities of individuals, households, and communities to adapt.

Discussion

The findings underscore the multifaceted barriers that climate-displaced students face in accessing education, with financial instability, administrative challenges, and gender disparities emerging as key concerns. Tackling these issues requires a comprehensive strategy that integrates targeted financial assistance, streamlined bureaucratic processes, and gender-responsive policies to ensure educational continuity and equity.

Financial Constraints as a Persistent Barrier

Financial instability is a challenge for students affected by climate change, whether they remain in their homeland or relocate. Climate-induced displacement disrupts household income, forcing families to deprioritize education in favor of immediate survival (ICRC, 2018; UNICEF UK, 2017; Weng et al., 2020). In LMICs, where social safety nets are limited, displaced students, particularly those from marginalized communities, face heightened risks of school dropout (Anderson, 2023). While economic interventions like scholarships and cash transfers have been proposed to support educational continuity, their implementation is hindered by bureaucratic inefficiencies and inconsistent funding (Sims, 2021; UNESCO, 2019, 2020).

To prevent educational disruption, governments and international organizations can explore scalable financial support mechanisms tailored to climate-vulnerable populations. Cash transfers, insurance schemes, and school-based financial aid programs should be designed with local implementation challenges in mind, ensuring accessibility and long-term sustainability. Beyond direct financial assistance, integrating education funding into broader climate adaptation policies can create more resilient support systems for displaced learners.

The Need for Administrative and Support Systems

Beyond financial challenges, displaced students struggle with administrative and institutional barriers that disrupt their education. Complex enrollment procedures, documentation requirements, and rigid education policies make it difficult for displaced learners to access schooling in their new locations (Mooney & French, 2005; UNESCO, 2020). Simplified registration processes and digital identification systems could significantly ease school entry for displaced students.

Access to education alone is insufficient if students lack the necessary support services to navigate the academic and psychological challenges of displacement. Academic assistance and mental health counseling are crucial in mitigating the long-term impact of forced migration on learning outcomes. To build an effective support system, there is an urgent need for robust data collection and evaluation frameworks to track immediate and long-term educational outcomes of displaced learners. This includes assessing access, academic performance, retention rates, and long-term socioeconomic mobility. Without comprehensive data, policies risk being reactive rather than proactive to address the education needs of displaced students.

Gender-sensitive Approaches in Climate-affected Education

Girls face compounded vulnerabilities in the context of climate-induced displacement. Economic hardship forces families to prioritize boys' education, while cultural norms and safety concerns increase the risk of early marriage and school dropout for girls (Chigwanda, 2016; Kwauk et al., 2019). Despite growing awareness of gender disparities in education, the impact of climate-related displacement on gender inequality remains under-examined.

Policies should integrate gender-sensitive strategies to ensure that displaced girls receive targeted financial support, access to safe learning environments, and protection from gender-based barriers to education. This includes community-based interventions to challenge entrenched gender norms and promote equal educational opportunities. Without such measures, the intersection of climate change, displacement, and gender inequality will continue to deepen educational disparities.

Research Gaps and Contributions

Despite increasing recognition of the educational challenges posed by climate displacement, several critical gaps remain in the research landscape. First, limited focus on climate-related displacement in EiE: While EiE is an established field, it has historically centered on conflict-induced displacement, with limited research dedicated to education in the context of climate-related disasters (Burde et al., 2016). Although natural disasters are acknowledged in emergency education frameworks,

operational research continues to prioritize conflict-driven crises over environmental disruptions (Kagawa, 2005). This study contributes to addressing this gap by framing climate-induced displacement as an educational emergency that requires distinct policy and intervention strategies.

Second, there is a lack of research on long-term educational outcomes. Existing studies primarily focus on immediate access to education, neglecting long-term impacts such as academic performance, mental health, and the cumulative effects of climate displacement on learning trajectories. This study underscores the need for research that examines chronic and systemic barriers beyond the initial phase of displacement, particularly regarding educational attainment, long-term economic mobility, and the intergenerational consequences of disrupted schooling.

Third, there are reactive rather than proactive policy responses. Policy solutions for climate-displaced learners have largely been short-term, addressing immediate educational disruptions without accounting for the protracted nature of climate displacement. Current education policies fail to integrate with climate adaptation strategies, leaving displaced learners vulnerable to long-term exclusion. This study highlights the need for climate-specific EiE frameworks that move beyond temporary relief and ensure sustained educational support for displaced students.

Conclusion

This study underscores the significant challenges that climate-displaced students face in accessing education, with financial instability, administrative barriers, and gender disparities emerging as key obstacles. Findings reveal that financial constraints force families to deprioritize education in LMICs where social safety nets are limited. Bureaucratic hurdles, such as complex enrollment procedures and rigid documentation requirements, disrupt displaced students' educational continuity. Without adequate academic and mental health support, the long-term effects of displacement can lead to educational disengagement. The study also highlights the heightened vulnerabilities of displaced girls, who face cultural and economic pressures that increase their risk of early school dropout.

To address these challenges, this research advocates for a comprehensive approach that includes scalable financial support mechanisms, streamlined administrative processes, and gender-sensitive policies to ensure equitable access to education. It identifies critical research gaps, including the limited focus on climate-induced displacement within EiE, the lack of long-term impact assessments, and the reactive nature of existing policy frameworks. By framing climate displacement as an educational emergency, this study contributes to expanding the discourse on climate change and education, emphasizing the need for proactive, climate-specific education policies that integrate with broader adaptation strategies. Ensuring educational continuity for climate-displaced students requires a shift from short-term responses to long-term, systemic solutions that recognize education as a right and a key component of climate resilience.

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New Jersey Teachers' Professional Learning About Climate Change

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During the 2022-23 academic year, New Jersey became the first state in the United States to adopt learning standards that support climate change education K-12 across all subject areas, offering an ideal context for exploring the relationship between education and climate change. Although New Jersey has provided financial funding to support teachers in teaching about climate change, little is known about teachers' preparedness to implement developmentally appropriate climate change instruction in K-12 settings. This study utilizes interviews from 50 New Jersey teachers who participated in a classroom observation study conducted during the 2023-24 academic year to describe their professional learning related to climate change. Though professional learning varied considerably across the dataset, most respondents indicated that self-directed learning was their primary mode of professional development about climate change, followed by attendance at workshops or webinars. Several participants reported having no access to professional development provided by their school or district on the topic, despite the introduction of standards. When asked about plans for future professional development related to climate change, the majority of interviewees asserted that they had plans, but these varied with their grade bands. The findings suggest that more coherent professional learning opportunities are needed to support teachers in integrating climate change into their teaching. More mechanisms should be implemented to acknowledge teachers' self-directed learning on climate change.

Keywords: Climate change education, educational policy, professional learning.

Introduction

2024 was the planet's hottest year on record, exceeding the record from 2023 (Vlock & Jacobs, 2025). The world is experiencing intensified effects of climate change, including increased floods, extreme weather, wildfires, and changes to ecosystems and biodiversity (National Oceanic and Atmospheric Administration [NOAA], 2023). New Jersey (NJ) residents face magnified climate change effects in comparison to other places in the United States (U.S.) (NJ Department of Environmental Protection [NJDEP], 2020). NJ is predicted to have more extended periods of higher temperatures, sea level rise, precipitation, related flooding, and drought events by 2050 due to a changing climate.

Children are among the most vulnerable to the effects of climate change (Environmental Protection Agency [EPA], 2023). Children should be placed at the forefront of climate change solutions. They are at increased risk for asthma and allergies, exposure to pathogens, and displacement from homes due to flooding (EPA, 2023). Higher heat

exposure has a negative correlation with students' academic achievement. The EPA notes that "temperature " increases of 2°C and 4°C of global warming are associated with, on average, 4 percent and 7 percent reductions in academic achievement per child, respectively, relative to average learning gains experienced each school year" (EPA, 2023, p. 6). To build a flourishing and resilient future, it is critical to both adapt education to meet the constraints educational systems face due to our changing climate and to educate children about climate change. As Woodard and Schulz (2024) noted:

> Today's children will undoubtedly have to learn about and adapt to this global emergency over the course of their lifetimes. Climate change education can help them to understand the causes, consequences, and potential solutions. It can also offer a space to reimagine and act toward a more just future. (p. 5)

Education about climate change is a powerful potential climate solution. Education is among the best tools for mitigating climate change through reducing atmospheric carbon emissions (Bapna, Simpson, & Colenbrander, 2024; Kwauk & Winthrop, 2021). Yet, the power of education is rarely leveraged in climate action plans. The United Nations Educational, Scientific, and Cultural Organization (UNESCO) reports that Sustainable Development Goal 4 on quality education was addressed in only two of 72 transnational climate initiatives covered in their 2024 Report, *Education and climate change: Learning to act for people and planet* (UNESCO & MECCE, 2024). Controversy surrounds efforts to support climate change education in many parts of the world, including the U.S. In some instances, policies prevent teachers from addressing the topic in their classrooms altogether (Kamentez, 2023; Waldman, 2023). The State of NJ has been at the forefront of climate change education over the past several years (Madden, 2022). In 2020, NJ's First Lady, Tammy Murphy, announced that the state would be the first in the U.S. to require learning standards to support climate change instruction across grade levels and subject areas (NJ Office of the Governor, 2020). Predictive studies suggest that education for climate change has the potential to reduce carbon emissions similarly to many of the top solutions suggested by Project Drawdown, such as transitioning to electric cars and concentrated solar panels[1] (Project Drawdown, n.d.; Kwauk & Winthrop, 2021). Including learning standards that address climate change directly in K-12 instruction can help to build a scientific knowledge base among all NJ citizens, preparing them to develop solutions to this monumental global problem.

Standards to support climate change learning (NJ Department of Education [DOE], 2022) were released in 2022. Their implementation began in 2022-23. Little is known about teachers' preparedness to implement climate change content in elementary school. Most climate change education studies focus on middle school and later (e.g., Bofferdint & Kloser, 2015; Plutzer & Hannah, 2018). The Next Generation Science Standards (NGSS) make explicit connections to climate change with the *Global Climate Change* Disciplinary

[1] Concentrated solar, electric vehicles, and education are predicted to reduce carbon emissions on the order of 10-20 gigatons.

Core Idea (DCI), but it is not introduced until middle school (National Research Council [NRC], 2013). My work studies NJ K-12 teachers' professional development experiences about climate change during the second year of the standards' implementation. Understanding the ways teachers can be supported in teaching about climate change confidently is critical for building a thriving, scientifically literate populace.

Teachers' Preparedness to Implement Climate Change Instruction

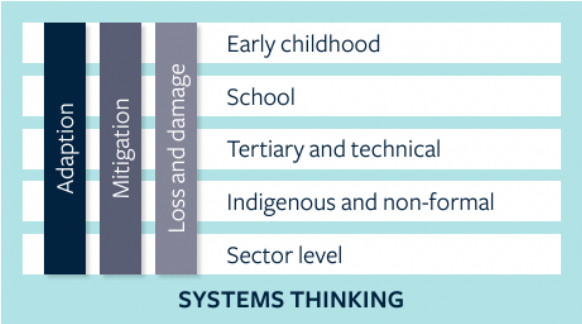
Though NJ's state-level governing structures provide an environment conducive to learning about climate change and require instruction in this area with specific standards, teachers' preparedness to implement the subject is varied. A survey-based study revealed that many teachers across NJ had low confidence in their ability to teach about climate change, and sometimes held misconceptions about the topic (Madden et al., 2023). The findings are not unique. Will (2023) reported that only 21 percent of U.S. teachers felt very confident in their ability to teach about climate change on a North American Association for Environmental Education (NAAEE)-sponsored survey, where nearly all respondents agreed that it was important to teach about the topic. Other research from the U.S. supports the notion that many teachers enter the profession feeling unprepared to cover climate change in the space of their classrooms, highlighting the critical importance of professional learning on the topic (Drewes et al., 2018; Kirk, 2017; Parnes et al., 2025). Studies demonstrate that climate change professional learning can result in increased confidence and content knowledge about the topic, yet exposure to this kind of professional learning is not always ubiquitous (e.g., Madden et al., 2023a; Drewes et al., 2018). Mavuso and colleagues (2022) found that despite nationwide efforts in South Africa, Nigeria, and Kenya to support climate change education, teachers had little guidance on how to do so, indicating a need for professional development. Amoakwa and co-authors (2024) found that teachers in Ghana requested professional learning to better prepare teachers to include climate change in their instruction. Greer and colleagues (2023) reported that fewer than half of the teachers surveyed in the United Kingdom reported receiving any professional development on climate change, and of those who did, much of their learning was self-taught. Ennes and others (2021) reported on barriers to U.S. teachers' engagement with professional development related to climate change, finding that a multitude of influences served as barriers, but time and teachers' confidence in their scientific knowledge about the topic were key factors.

Conceptual Framework

Bapna and colleagues (2024) put forth the Climate-Education Research Framework (CERF, Figure 1), which illustrates many of the overlaps between climate change and education within the context of systems thinking. The CERF framework delineates the different categories of education (horizontal) with types of learning about climate change (vertical). All of these different categories overlap and affect change at the systemic level. Figure 1 below depicts this framework:

Figure 1

The Climate-Education Research Framework (Bapna et al., 2024)[2]



The CERF framework asserts that climate change education occurs at all levels through formal schooling, non-formal (or informal) learning settings, and various sectors through professional development. It acknowledges that climate change education encompasses adaptation and mitigation to climate change effects, as well as understanding specific examples of lasting effects of climate change, including loss and damage. I focus on how teachers are prepared at the sector level through professional learning about climate change itself and how to teach it across early childhood, primary, and secondary school settings. The systems-thinking underlying the CERF framework allows for identifying how factors in one component of the framework affect others (e.g., sector-level issues influencing early childhood and school settings). The CERF framework asserts that climate change education can take many forms and address the components of climate change education (adaptation, mitigation, and loss and damage).

Methodology

The study takes place within a larger statewide project examining K-12 climate change instruction in NJ. It included observations and interviews with teachers in NJ to give a snapshot of the status of climate change education approximately one year into the implementation of new learning standards. 50 teachers joined. Observations took place in 20 of NJ's 21 counties. Teacher participants were spread evenly across grade levels: 17 taught at elementary schools, 16 at middle schools, and 17 at high schools (Table 1).

Table 1

Distribution of teacher observations across grade levels

Grade Level	Participating Teachers
Elementary School: Grades K-5, ages ~5-11	n=17 (34%)
Middle School: Grades 6-8, ages ~11-14	n=16 (32%)
High School: Grades 9-12, ages ~12-18	n=17 (.34%)

[2] Retrieved from https://media.odi.org/documents/ODI-OM-CERF-WP-Feb24-Proof05.pdf

Participating teachers comprised a voluntary response sample. Recruitment took place via email outreach to professional teacher listservs and social media posts on LinkedIn, Instagram, and Twitter/X. The participating teachers responded to these calls for participants by completing a survey. Participants invited researchers to their classrooms to observe a lesson of his or her choice. A team of four researchers from The College of New Jersey observed the teachers, with a researcher visiting a classroom at a time. Lesson duration varied by teacher and ranged from approximately 30 minutes to just under two hours, with most observations in the 50-60 minute range. The observer sketched the classroom or learning space and documented what the teacher and students were doing for each of the lesson segments. The observer recorded which instructional strategies and curricular materials were used during the observed lesson.

Teachers were observed teaching a climate change lesson during the 2023-24 academic year.[3] Following the observation, the researchers interviewed each participating teacher over Zoom to debrief and provide context for the observation. The interviews were transcribed. Names and identifying information were removed. During these interviews, teachers described their professional development experiences related to climate change and plans for future professional learning related to climate change. Researchers coded the teachers' responses to these questions using a grounded approach (Saldana, 2015).

Participants

Around a third of teachers fell into each grade band. While most observed lessons were in science classes, researchers observed various subjects and classroom settings (Table 2).

Table 2

Teaching assignments for each of the observed teachers

	Elementary n = 17	**Middle School n = 16**	**High School n = 17**	**Total N = 50**
Elementary General Education	12 (71%)			12 (24%)
Elementary Inclusion	2 (12%)			2 (4%)
Art	1 (6%)	1 (6%)		2 (4%)
Technology	1 (6%)		2 (12%)	3 (6%)
Science	1 (6%)	8 (50%)	11 (65%)	20 (40%)
English Language Arts		3 (19%)		3 (6%)
Mathematics		1 (6%)		1 (2%)

[3] Since the participants were volunteers and recruited from the author's professional network, there is potential for bias within the sample.

Social Studies		1 (6%)	1 (6%)	2 (4%)
Physical Education		1 (6%)		1 (2%)
Multidisciplinary Advisory		1 (6%)		1 (2%)
World Languages- Spanish			2 (12%)	2 (4%)
English as a Second Language			1 (6%)	1 (2%)

Elementary Teachers

12 of 17 teachers (71 percent) were classroom generalist teachers in grades ranging from K-5. 2 were teachers in inclusion classrooms (12 percent). The remaining 3 (18 percent) were 'specials' teachers (1 art teacher, 1 technology teacher, and 1 science specialist).

Middle School Teachers

8 of the 16 middle school teachers were science teachers. 3 (19 percent) were English-Language Arts teachers. Just a teacher (6 percent) taught each of these subjects: Mathematics, Art, Multidisciplinary Advisory, Social Studies, and Physical Education.

High School Teachers

Of the 17 participating high school teachers, a large majority were science teachers, 11 or 65 percent were science teachers. Two, or 12 percent, were Spanish teachers, and another two, or 12 percent, were Technology teachers. A teacher (or 6 percent) taught these subjects: English as a Second Language, Technology, Art, and Social Studies.

Research Questions

My study asks what kinds of professional learning experiences related to climate change are reported by teachers engaging in standards-aligned instruction on climate change? And what are teachers' plans for future professional learning on climate change?

Data Sources

After each classroom observation, the teacher participant engaged in a debriefing interview with the observer within 48 hours of the observation. The interviews lasted approximately 20 minutes and followed a semi-structured protocol. Researchers asked the teachers, *How did you prepare for teaching about climate change?* And *do you have any plans for future professional development on climate change? If so, what are they?* The interviewers were encouraged to probe for information regarding formal coursework, workshops, school- or district-provided professional development, and self-directed learning. The interviews took place synchronously over Zoom. They were audio recorded and automatically transcribed. Each interviewer returned to the transcript to remove identifying information and correct any transcription errors.

Data Analyses

Interview transcripts were coded using a grounded approach (Saldana, 2015). Trends and themes that emerged across responses were identified using constant comparison. These trends and themes were used as organizational categories. Sub-trends from within these categories emerged and are described in the findings. Most of the themes were in line with the researchers' expectations, as the interviewees were responding to specific questions about their professional learning. If a teacher mentioned attending a specific workshop, their response was coded in the category of webinars and workshops. The interviewers probed the teachers to identify self-directed type activities that might not always be considered professional development, such as reading or listening to podcasts. If teachers identified these types of tasks, they were coded as self-learning with subcategories for the type of professional learning (e.g, reading, documentaries, etc.).

Though the focus of this study is on teachers' preparedness and professional learning about climate change, some teachers shared information throughout their interviews that shed further light on their experiences. Participants shared whether they had the support of administrators. Others commented on the importance of seeking information from reliable sources for their professional learning, as well as information they shared with the children in their classes. These findings provided context on teachers' approaches to professional learning about climate change, and are also presented below.

Findings

The large categories in types of professional learning that emerged from the analysis were: self-directed learning, workshops or webinars, and relying on prior knowledge and experiences (Table 3). These categories included sub-themes, which I unpack further below. Responses that were coded 'self-directed' indicated teachers sharing that they sought out resources of many kinds (readings, videos, podcasts, social media feeds, etc.) to supplement their content knowledge, and to possibly share with their students. If a teacher noted a workshop, workshop series, webinar, or webinar series focused on climate change-related content or pedagogical skills and techniques for teaching climate change, it was coded as 'webinars or workshops.' If a teacher referred to prior knowledge from earlier coursework at the undergraduate or graduate level, or prior work or life experiences, it was coded 'prior knowledge.' Note that in many cases, teachers listed one or more examples of types of professional learning they experienced. Category totals are higher than 100 percent across all categories and grade bands.

Table 3

Distribution of professional learning experiences cited among observed teachers

	Elementary Teachers (n = 17)	**Middle School Teachers (n = 16)**	**High School Teachers (n = 17)**	**Total (N=50)**
Self-Directed	13 (76 %)	11 (69%)	13 (76%)	37 (74%)

Webinars or Workshops	10 (59 %)	9 (56%)	13 (76%)	32 (64%)
Prior Knowledge	8 (47%)	3 (19%)	11 (65%)	22 (44%)

Self-Directed Learning

Nearly three-quarters of the participants (37 out of 50, or 74 percent) reported engaging in self-learning about climate change. The examples given were varied but included readings, documentaries, news programming on television, radio, or podcasts, websites, and social media pages addressing climate change.

Twenty-three of the participants (6 elementary teachers, 7 middle school teachers, and 10 high school teachers) cited reading books, magazines, or news media sources. One elementary teacher shared, "I like to keep an eye out for any articles that come my way, related to climate change, and share those with the students," in her interview. Another elementary teacher noted, "I am always trying to stay abreast of everything in the news about climate change. That way, in turn, I am knowledgeable so that I can do my job as a teacher, but also turn the information over to other colleagues." A middle school teacher emphasized sharing readings she did outside of class with her students:

> I read some articles and brought them to my students. They were about Christmas trees, and how we are using trees, and whether natural or artificial is better for the environment. I let the students discover and come to conclusions on their own after reading.

A high school teacher noted:

> I read a lot. I typically have three books in my circulation. I usually have one nonfiction book, one book based on my interests, and then at least one science book, which could be either anatomically themed or environmental science. They all inevitably bring up climate change, even if it's not a climate change book.

4 interviewed elementary school teachers described watching documentaries or other video-based informational sources about climate change as part of their professional development on the topic. A teacher shared, "I learn a lot about climate change from watching documentaries on Disney like *Planet Earth*." 3 middle school teachers expressed how they used documentaries or videos for self-directed learning on climate change. In the words of one middle school teacher talking about a video she found:

> Adidas is collecting plastic bottles off of coastlines, taking those plastic bottles, turning them into threads, and then making their shoes out of them, called Parlay. They recently made a completely recyclable shoe. So when you are done with that shoe, you ship it back to them, and they recycle it into a new shoe. I learned a lot from that video and shared it with my students.

7 high school teachers cited videos or documentaries they used as sources for self-directed learning during their interviews. A teacher mentioned the Netflix series *You Are What You Eat*, which helped him frame some thinking about broader climate solutions. In his words: "teaching kids that it is not just about buying an electric car. It is about what you eat because that is a huge part of climate change, you know, getting away from a meat-based diet, getting more water, and a plant-based diet."

2 elementary teacher participants explained that they followed various professional organizations and teachers on social media as part of their self-directed learning. For instance, "on my social media platforms, I follow a lot of different teachers and a lot of different entities ranging from NASA to the National Wildlife Federation to Audubon." No middle school teachers shared about social media feeds from professional organizations, but 4 high school teachers did. A high school teacher mentioned the organization Save Coastal Wildlife's social media presence and his affiliation with them:

> I went and did their winter seal survey with them. So it is located in Sandy Hook. They get harbor seals, sometimes gray seals, very rarely harp seals, but my zoology teacher and I went a couple of winters ago, and then last year we took the kids.

4 elementary school teacher respondents described researching their curricular materials using the NJ standards as a guide for better understanding ways to integrate the topic into their teaching. For example:

> I have been preparing by reading the district's curriculum guides, available on the district website. Anybody can view them but become knowledgeable through the resources and activity guides that they share, and look for places to drop in the climate change context where it makes the most sense.

A middle school teacher shared about curricular connections, along with 4 high school teachers. A high school Spanish teacher discussed using climate change as an opportunity for bilingual communication: "There are limited handouts and limited signs in Spanish. So we are thinking of how being bilingual can enhance bilingual communication and can enhance the global push towards addressing climate change in various and various areas."

Workshops or Webinars

Another large group of participants (32 out of 50, or 64 percent) shared that they participated in workshops or webinars related to climate change. 10 were elementary school teachers, 9 were middle school teachers, and 13 were high school teachers. Not all interviewees gave specifics about the workshop or webinar providers, but those who did fell into several large categories, including national or international organizations, institutions of higher education, and informal learning centers such as nature centers and museums. Only 2 of these respondents described a workshop hosted by their school

or district. This is an indication that teachers did not necessarily have access to professional learning opportunities about climate change provided by their schools, and instead had to seek these out on their own. An elementary teacher made a point to directly address this, "I would say that preparing to teach about climate change for me is made up of 100 percent of things outside of the official PD that my school offers."

Several interviewed teachers (5 at the elementary level, 3 at the middle school level, and 8 at the high school level) cited webinars or workshops hosted by national or international organizations such as Audubon, the National Science Teaching Association (NSTA), Climate Generation, and SubjecttoClimate. For example, an elementary teacher shared, "I participated in the NSTA's webinar series where they helped align lessons to climate change content." Another elementary teacher mentioned:

> I am participating in the Subject to Climate workshops where they walk you through the science of climate change, the social, emotional learning aspects, and the ways to spark student action. For me, that propelled me to open my eyes and become more aware of opportunities where I could integrate it.

A middle school teacher noted, "I went to a formal presentation on environmental economics run by the New Jersey Council for Economics, which included climate change." A handful of participants mentioned professional development events hosted by institutions of higher education (two elementary teachers, 4 middle school teachers, and 3 high school teachers). For example, a middle school teacher mentioned, "Columbia College has this great guy who runs an Earth workshop. He takes scientists and brings them together with teachers, mostly high school teachers. I have attended those." 2 respondents discussed workshops or webinars hosted by informal learning sites, a teacher at the elementary school level, and another at the high school level.

Prior Knowledge and Experience

Twenty-two of the 50 participants (44 percent) shared that they relied on their prior knowledge and experience to prepare for teaching about climate change. These included 8 elementary school teachers, 3 middle school teachers, and 11 high school teachers. These teachers mentioned a variety of different ways in which they built their prior knowledge. For example, several discussed classes that they took as part of their undergraduate or graduate coursework, such as one high school teacher who described:

> Way back when, for my undergrad, I went to the [university], and they had this idea of allowing students to apply to these programs as freshmen, and they were a strand of four classes, and the one that I applied to and was accepted into was all on environmental science. I learned a lot there.

Others mentioned personal interests or passions about climate change. As one elementary school teacher noted:

> I remember being in high school around 1988, and there was a magazine that I subscribed to at the time with a cover story on what was then called global warming. Since then, I have been learning about the topic. We've been talking about this in a big way for decades.

Still other interviewees referred to prior careers related to environmental education. A high school teacher shared: "I have spent my entire career in wildlife biology and conservation. Now, I am focusing more on how to teach and design the curriculum." Another high school teacher shared, "I received my undergrad degree in Wildlife Biology at Stockton University and a graduate degree from Clemson University in Environmental Science and Sustainability. After working in the field for years, I just wanted to come back home and teach." These teachers drew on prior career experiences to build their knowledge bases for teaching about climate change.

Other Trends

Discussing professional learning, more trends emerged among teachers. Some noted that at the elementary level, English-language arts and mathematics take priority over science and social studies. As a result, climate change can end up on the back burner. Of the 50 teachers who invited researchers into their classrooms, the researcher was greeted or acknowledged by an administrator in just six (12 percent) of the observations. Using reliable sources for self-directed professional learning and then sharing with students was also important. As an elementary teacher explained:

> I am spending time just staying one step ahead of the students and trying to figure out exactly what sources are good sources for accurate climate change information. Because it is a touchy subject, because you know exactly what and what makes sense for your students [developmentally], and what uses evidence-based and science to make conclusions. I have been using the US EPA and NASA websites a lot.

Information literacy was a critical component of teachers' planning process when developing climate change lessons.

Future Plans for Professional Learning

The vast majority (37 out of 50) participants discussed plans for future professional learning, and in many cases (23 out of 37, or 62 percent), these teachers had specific ideas about their future professional development, as displayed in Table 4 below.

Table 4

Plans for future professional learning among observed teachers

	Elementary Teachers (*n*=17)	**Middle School Teachers (*n*=16)**	**High School Teachers (*n*=17)**	**Total (*N*=50)**

Intend to attend climate change-related professional development in the future	16 (94 %)	12 (75%)	9 (53%)	37 (74%)
Specified ideas for future professional learning	11 (64 %)	7 (44%)	5 (29%)	23 (46%)

Nearly three-quarters of the observed teachers commented that they were planning to continue learning on their own about climate change. Many teachers noted that they did plan on attending future professional development, but did not specify in what way they hoped to engage. For example, a high school teacher said, "I do want to continue learning about climate change, because I think this is the most important issue that we have in our time." Similarly, an elementary teacher shared:

> Yes, I do plan to continue to learn about climate change, because I think it is a very important thing. Not just for me to know as an individual, but I think as an educator. You know, we hold a pretty empowering torch that can be passed on, and I think if we don't do our best, then it could fall to the wayside.

The statements were promising but did not show how or what the teachers hoped to pursue learning about through professional development. Yet, other teachers shared specific plans about their future professional learning, which tended to follow the same general themes as their prior professional learning, mentioning things like self-directed learning, workshops and webinars, and formal coursework. A middle school teacher noted, "Next year I will probably try to read more about climate change," while another shared, "I got accepted to attend a professional development workshop at the Museum of Natural History about starting conversations about keystone species with students." An elementary school teacher shared that she hoped to learn more about how to integrate climate change into novels: "I do plan on continuing learning about climate change down the road. It. It worked out well to insert climate change and care for the environment into this book, and I would like to learn how to integrate it differently." The interviewed teachers' plans for future professional learning differed among grade bands taught. Elementary school teachers were nearly unanimous in their interest in pursuing future professional learning (94 percent), and this percentage decreased to 75 percent at the middle school level and 53 percent at the high school level.

Conclusion

From this statewide study, it is clear that even in a state where climate change education is required, professional learning opportunities for teachers are inconsistent. Similar to what Greer and colleagues (2023) found among United Kingdom teachers, many of those who participated in this study (74 percent) engaged in self-directed learning related to climate change. While this type of experience can build science content

knowledge, these self-directed experiences cannot be quantified in a way that attendance at workshops or coursework in higher education can, or done in a way that provides a coherent experience for all teachers within a school, district, or state. There is no way to measure the quality or accuracy of information conveyed in self-selected learning materials. There is little opportunity for this type of self-directed learning to count toward teachers' professional learning requirements, which could potentially decrease teachers' motivation for seeking out information on their own. The challenges with self-directed learning experiences are amplified when we consider that very few (just 2, or 4 percent) of the participants in this study were allowed to explore climate change learning opportunities through their schools or districts.

The small number of school administrators who acknowledged researchers visiting their classrooms (6, or 12 percent) suggests that school district support for climate change education, or climate change professional development, may not be strong enough to support implementation at schoolwide scales. The observed support from school district administrators was mixed across the dataset. However, the finding that elementary school teachers were much more likely to have plans for future professional development was promising. Existing curricula aligned to the NGSS introduce climate change at the middle school level, indicating that there is a greater need to support teachers in the elementary grade levels. Many of the participating teachers described efforts to ensure they were accessing reputable resources, understanding the best places to integrate climate change into existing curricula, and committing to professional growth. Given that they were volunteer participants, it is likely that they already felt confident teaching about climate change. Mechanisms should be created to help leverage the experiences of these already confident teachers to provide in-house expertise as schools take on the challenge of adopting the new climate change standards. As this global issue continues to negatively impact our planet, it is critical to develop the skills and knowledge in children to innovate solutions. Creating standards around climate change is an excellent first step, but teachers should also have the tools they need to effectively implement this content in a comprehensive and meaningful way.

Perhaps one strategy for leveraging the collective knowledge of teachers who are already confident about climate change content and the prevalence of teachers engaging in self-directed learning is to implement professional learning communities or reading discussion groups within schools or districts centered on shared experiences. These types of activities could fit within the scope of a teacher's standard planning periods and would not require additional funding, transportation, or substitute teacher costs. They could also boost morale, as teachers who are already knowledgeable about the topic could serve as in-house experts. Another strategy could be including legislation around climate change professional learning, which might include a requirement to expose all teachers to some baseline content knowledge and pedagogical skills, which would support widespread implementation of these standards.

Climate change is perhaps humanity's greatest challenge, and teachers must be prepared to introduce this content effectively. This study provides an inside look at teachers' current level of preparedness to tackle this topic in a state where teaching about climate change is required. The findings can be used to inform professional learning efforts both in states that require climate change education and those that do not.

Lauren Madden *is a Professor of Elementary Science Education at The College of New Jersey, where she also coordinates programming in Environmental Sustainability Education. Her current work focuses directly on climate change education. Her book,* Climate Change Education Across Disciplines K-12: New Jersey and Beyond*, released in February 2025, shares advice and recommendations from 42 author-experts in an edited volume. Dr. Madden's expertise has been featured prominently in many media outlets, including the New York Times, Washington Post, The Guardian, NPR, and the Star Ledger.*

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Bridging Worlds, Healing Scars: A Student-Teacher Journey Toward Climate-Just Education

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Our paper is a collaborative autoethnography exploring the intersection of environmental crises, personal experiences, and education through the narratives of two educators, Maha Shoaib and Sarah Kistner. Reflecting on the 2005 earthquake in Pakistan and the 2021 Texas Freeze, we explore how systemic inequities and inadequate preparedness exacerbate the impacts of disasters on marginalized communities, disproportionately disrupting educational systems. We argue for climate-just education as a restorative and healing approach, addressing inequities at the school, community, and individual levels. Climate-just education proposes a holistic framework for trauma-informed and climate-responsive education, emphasizing preparedness, mutual support, and the creation of open spaces for teachers and students to share, heal, and rebuild. At the individual level, practices such as the Butterfly Hug Technique, Emotional Freedom Technique (EFT), and Yoga Nidra are presented as tools for fostering self-healing and mutual healing among students and teachers. Concluding with a vision for climate-just education, we advocate for reimagining schools as transformative spaces that empower communities to adapt to and recover from environmental crises while fostering emotional resilience, equity, and sustainability.

Keywords: Climate-just education, trauma-informed teaching, collaborative autoethnography, healing-centered pedagogy, disaster preparedness.

Introduction

"Hello? Hello? Are you safe? Where are you? Please find shelter fast." These words became a haunting refrain for both of us—Maha Shoaib and Sarah Kistner—during separate moments of environmental crisis. Though we lived in different parts of the world—Maha in Pakistan during the catastrophic earthquakes in 2005 and Sarah in the United States during the devastating Texas freeze in 2021—these words echoed through our phones, our minds, and eventually, our lives. They marked moments of fear, displacement, and the beginning of a deeper, lifelong commitment to climate justice through education.

Our paths first crossed in Fall 2022 as first-year master's students in the International Education Policy program at the University of Maryland. Though our academic journeys diverged after that semester, we reunited in Fall 2024 as first-year PhD students enrolled in a course on International Higher Education. An assignment on autoethnography and applied contemplative inquiry offered a space to reconnect—not just intellectually, but

emotionally and spiritually. As we revisited the disasters that shaped our lives, we began to uncover a profound bond: a shared trauma and a shared calling.

The work and words of Bessel van der Kolk (2014) resonate deeply with us: "Trauma is not just an event that took place sometime in the past; it is the imprint left by that experience on mind, brain, and body" (p. 21). For both of us, the climate crises we experienced were not isolated incidents—they were deeply embodied traumas that continue to shape our sense of purpose and our approach to education. Our experiences compelled us to ask:

- How can educational systems serve as spaces for emotional and psychological healing in the aftermath of disasters?
- What transformations are needed for education to function not just as a site of knowledge, but as a force for climate justice and collective healing?
- How can collaborative autoethnography, as both method and process, support the personal and communal healing of trauma across different global contexts?

Despite the extensive research on climate education, practice still neglects the embodied realities of trauma, especially how teachers and students experience, remember, and heal from disasters. Current literature focuses on curricular innovations, pedagogical strategies, or systemic policy reforms. What is missing, however, are personal, affective, and embodied accounts of how climate trauma is lived and remembered, particularly within educational spaces. The emotional and psychological toll of environmental crises on learners and educators alike remains underexplored, especially through methodologies that center vulnerability and storytelling. There is a notable lack of research that brings together scholars from the Global South and Global North to reflect on shared yet asymmetrically experienced climate disruptions.

Our paper addresses these gaps by using collaborative autoethnography (Chang et al., 2016) as a method of inquiry and healing. As scholars from different geopolitical, cultural, and ecological contexts, we explore how climate trauma has impacted our personal and professional trajectories, and how education has both failed and supported us in navigating these experiences. Our approach offers a comparative lens that interrogates the relational and affective dimensions of climate trauma and justice, allowing us to reflect not only on our own stories but on the broader educational systems we inhabit and seek to transform.

By grounding our research in contemplative inquiry, lived experience, and critical reflection, we position this paper at the intersection of climate justice, trauma-informed education, and transnational solidarity. We contribute to reimagining educational spaces

as places of healing, transformation, and justice, particularly in a time when the climate crisis continues to reshape what it means to live, learn, and be human.

Education in the Wake of Disasters

The frequency and severity of disasters disrupt education. The Intergovernmental Panel on Climate Change (IPCC) (2021) underscores such events' growing unpredictability and severity. In the wake of these disasters, marginalized communities—already grappling with systemic inequalities and resource limitations—bear the brunt of the impact. Disasters often deepen pre-existing inequities, pushing vulnerable populations into survival mode and frequently displacing education as a priority (World Bank Group, 2018). This calls for an urgent reimagining of education systems through a climate justice lens—one that is adaptive to environmental shifts and responsive to the emotional, psychological, and social consequences of such crises.

Climate justice moves beyond the pursuit of environmental sustainability to confront the unequal distribution of climate-related burdens along lines of geography, race, gender, class, and ability (Fraser, 1997; Schlosberg & Collins, 2014). In educational contexts, climate justice emphasizes the need for learners to engage critically not only with scientific knowledge but with the socio-political and ethical dimensions of the climate emergency. As Kagawa and Selby (2010) argue, education should transcend awareness-raising to interrogate the root causes of climate change, including colonialism, capitalism, and global inequality. Education becomes a vehicle for collective action and transformation, anchored in equity, accountability, and historical responsibility (Stevenson et al., 2017).

In post-disaster contexts, education is sidelined as immediate survival needs take precedence. Schools are damaged or destroyed, communities are displaced, and children are forced to abandon learning. This is detrimental in marginalized settings where schools may serve as critical sites of stability and support. As Buchmann and Hannum (2001) observe, schools offer continuity and structure in the face of chaos. This fragile stability is among the first to erode during environmental crises. The loss of access to education, especially for girls and children in rural or impoverished regions, halts academic progress and exacerbates emotional trauma and social isolation (Malala Fund, 2021). A climate-just education should extend beyond physical reconstruction to incorporate emotional healing and psychosocial support into recovery efforts.

Contemporary models of climate education often prioritize Western epistemologies and technocratic solutions, marginalizing Indigenous, local, and experiential knowledge systems (McGregor, 2009; Whyte, 2017). This perpetuates epistemic injustice and hinders education's potential to foster transformative and culturally responsive responses to climate disruption. There is growing recognition of the need for pedagogies that acknowledge the existential and emotional dimensions of the climate crisis, particularly for youth and frontline communities (Leduc, 2021; Ojala, 2016). These approaches

advocate for education that is not only critical but healing, attuned to grief, anxiety, and the complex emotional terrain of climate trauma.

Trauma-Informed and Healing-Centered Pedagogies

Trauma-informed education has emerged as a powerful approach to supporting students and educators affected by adversity, including those living through war, displacement, and systemic violence (Carello & Butler, 2015; Sporleder & Forbes, 2016). Trauma-informed pedagogy prioritizes emotional safety, recognizing how traumatic experiences can impact learning, behavior, and social functioning. Ginwright (2018) contends that this approach should move beyond simply accommodating trauma toward transforming educational spaces into environments of collective care, resilience, and agency. Emerging scholarship on healing-centered pedagogy expands this vision, emphasizing storytelling, identity reclamation, and community-based healing practices (Love, 2019). This resonates strongly with climate justice, where trauma is both deeply personal and inherently planetary. The intersection of climate trauma and trauma-informed education remains underexplored, particularly in higher education and within comparative or transnational frameworks.

Autoethnography and Contemplative Inquiry as Method

Our study draws on collaborative autoethnography, a qualitative method that integrates personal narrative and cultural analysis to examine lived experiences within broader social and institutional structures (Ellis et al., 2011; Chang et al., 2016). In contexts of trauma, autoethnography offers a powerful means of validating emotional truths, processing grief, and reclaiming agency through storytelling (Douglas & Carless, 2013). When practiced collaboratively, it allows researchers to engage in dialogue, mutual witnessing, and relational healing. Contemplative inquiry informs our methodological framework by integrating mindfulness, self-awareness, and deep listening into the research process (Zajonc, 2013). These practices are epistemological and ethical, enabling researchers to hold uncertainty, metabolize eco-anxiety, and cultivate compassion in the face of environmental loss (Fisher, 2021). Within climate justice work, such approaches offer critical tools for processing trauma and imagining hopeful futures.

Bridging the Global South and Global North

Despite increasing global concern around climate change, the voices and knowledge systems of communities in the Global South remain marginalized in dominant educational and policy discourses. As Chakrabarty (2009) and Nixon (2011) argue, the global narrative of climate change often overlooks the uneven geographies of risk, trauma, and responsibility.

We center our positionalities as researchers from Pakistan and the United States. Through collaborative autoethnography, we explore the intersections of our lived experiences, emotional landscapes, and shared commitments to climate justice. By engaging in transnational dialogues, we seek to illuminate the divergent and convergent experiences of climate trauma and to cultivate solidarities across borders. The healing we envision should address the gaps in educational recovery that typically follow disasters. The emotional toll of environmental crises often remains unaddressed, leaving students and teachers without the support needed to process trauma and reconnect with their educational goals. To create a truly climate-just education system, we argue that it is essential to move beyond a focus on physical recovery and incorporate mental health support into recovery plans. This approach ensures that students and educators possess the emotional resilience necessary to resume their education and rebuild their lives. By integrating restorative practices into disaster recovery, we can cultivate an education system that not only helps students catch up on missed lessons but also provides the emotional tools necessary to heal from the psychological scars of environmental trauma.

Methodological Approach: Collaborative Autoethnography in Educational Contexts

We share our personal experiences as students and educators who have faced environmental crises, offering insights into disasters' emotional and educational impacts. Engaging in this reflective practice not only deepened our understanding of the power of shared storytelling and became a transformative process of collective healing. This process unfolded in a series of reflective journals, semi-structured interviews, and shared storytelling sessions. We explored the perspectives of two critical stakeholders in education: students and teachers. Each of us kept a journal over the semester, documenting our emotions, experiences, and reflections on the educational practices during and after the environmental crises we experienced. We held bi-weekly check-ins to gauge our progress and carve out space to process our feelings with one another.

Braun and Clarke's (2006) thematic analysis framework served as a tool for us to identify prominent patterns from our qualitative narratives collected through reflective journals, interviews, and storytelling sessions. Our key findings from the analysis of our data are the following:

- The synthesis revealed that **emotional burdens** were prevalent in educational spaces, often exacerbated by a lack of adequate support systems. Both Student and Educator emphasized the **urgent need for structured support**.
- Despite the challenges, there was a notable theme of **resilience in the face of uncertainty**, demonstrating the capacity of individuals to adapt and persevere.
- The **necessity for healing** emerged as a critical theme, underscoring the importance of integrating emotional and psychological recovery into educational frameworks to foster a climate of well-being and growth.

Our collaborative autoethnography, grounded in trauma-informed methodology, became an act of shared reflection and collective healing practice, transforming personal

trauma into collective wisdom. As Ellis and Bochner (2000) suggest, such storytelling fosters deeper connections, turning pain into insight that can lead to transformative change. This practice serves as a healing journey and a call for action toward a climate-just education.

Discussion and Analysis

Reflecting on our experiences—one as a student and the other as a teacher during an environmental crisis—we discovered that sharing these personal moments became an act of mutual care. It allowed us to uncover emotions we had not realized were still present. Re-living these overwhelming events felt less isolating when shared across borders, reminding us that vulnerability can serve as a bridge to connection.

We offer a narrative exploration of our experiences with the 2005 earthquake in Islamabad and the 2021 Great Texas Freeze in Austin. Our goal is to demonstrate how collaborative autoethnography can uncover hidden emotional truths, serving as a tool to imagine more compassionate and equitable educational environments. By weaving together our stories, we aim to highlight how environmental crises intersect with issues of access to education, gender, mental health, and belonging. We contribute to the envisioning of a climate-just education system: resilient, inclusive, and responsive to students' and teachers' needs.

Living Through Environmental Crises

Maha Shoaib. I was born and raised in Islamabad, Pakistan, and lived there before moving to the United States for my master's degree. I completed my education up to the bachelor's level in Pakistan and then spent two years teaching in a rural, under-resourced community. Immersing myself in the daily realities of that setting gave me a micro-level understanding of educational challenges and deepened my desire to pursue global education policy. Growing up in a middle-income family, I was often told that education was our only path to a better future. From a young age, I felt the weight of expectations. I wanted to make my family proud.

Pakistan is a country of breathtaking landscapes and four distinct seasons. As a nation close to the equator, we are experiencing the intensifying effects of climate change. Every year, torrential monsoon rains trigger devastating floods across the country. As I sit today with a warm cup of tea in hand, I find myself reflecting on my childhood—the moments when environmental crises shaped not just the world around me, but the course of my life. One of the most defining moments was the 2005 earthquake, an event that shaped my understanding of disaster, resilience, and the urgent need for emotional and systemic support in the aftermath of such catastrophes. Islamabad, my hometown,

is nestled against the majestic Margalla Hills. More than just the capital city, it is a delicate blend of green spaces, modern architecture, and cultural diversity. I spent my formative years at Islamabad Convent School in the H-8 sector, a relatively affluent neighborhood. The school symbolized opportunity, with cutting-edge technology, a beautifully designed campus, and a sprawling playground where I spent countless hours with friends. Life felt predictable, safe, and full of promise.

October 8, 2005, was a Saturday like any other. I was asleep, enjoying the rare luxury of a weekend free from school. Without warning, the earth began to shake. At first, it felt distant and strange. But within seconds, the tremors intensified. My mother's urgent voice pierced the air as she yelled for us to run. I stumbled out of bed, heart pounding, and we rushed outside, joining neighbors who were fleeing their homes in panic. The screams, the confusion, the raw fear—it was overwhelming. When the shaking stopped, a heavy silence fell. It was as if the city had gone still, holding its breath in the face of unspeakable loss.

The earthquake, measuring 7.6 on the Richter scale, devastated large parts of northern Pakistan, India, and Afghanistan, claiming over 73,000 lives and injuring more than 69,000 people (**United Nations Office for the Coordination of Humanitarian Affairs** [OCHA], 2005). Though our family was safe, the emotional toll was immense. The news reports painted a grim picture: entire towns destroyed, thousands of children trapped under rubble, and schools reduced to dust. As a child, I struggled to process the scale of the destruction. My heart ached for the families who lost everything.

When I began to talk about that experience years later, the emotions I had buried rose to the surface. I recalled how every aftershock felt like a cruel echo of that day—how we braced at the slightest vibration. At school, we practiced evacuation drills regularly, running out at the first sign of tremors. But no one asked how we were coping emotionally. We were taught how to protect our bodies, but not our minds. The fear settled in like a shadow, unacknowledged and unspoken. We carried it silently.

After weeks of closure, when school resumed, everything felt different. The air was thick with anxiety. We were told to focus on our lessons, but our thoughts were consumed by worry. What if another earthquake struck while we were in class? What if our families were not safe while we were away? Teachers tried their best to maintain normalcy, but they were not equipped to help us process the trauma. Some of my classmates never came back—their families had been displaced, or they could no longer afford school fees. For many girls, education was among the first things to be sacrificed when families faced economic hardship.

Though I was able to continue my education, I could not ignore the inequality around me. In lower-income areas, schools remained closed for months. Rebuilding was slow, and the lack of infrastructure left many children waiting for a return to the classroom. The earthquake exposed the deep cracks in our education system. It revealed how

trauma was overlooked, and how crises could easily push the most vulnerable, especially girls, further to the margins.

When I shared this with my co-author, I felt I was unlocking memories I had not processed. Speaking aloud was cathartic as I understood how these experiences had shaped my journey. My passion for education policy, climate justice, and creating safe, supportive learning environments made sense. Schools should be more than spaces of academic instruction. They need to be sanctuaries where students feel seen, supported, and safe. We cannot prevent disasters, but we can ensure that no child feels alone in the aftermath. Our shared stories of survival and resilience can inspire systems to be more compassionate. While we may not control the ground beneath us, we can shape the foundations of the world we build above it.

Sarah Kistner. I grew up in a rural Pennsylvania township, where the one-mile-wide geographical constraints shaped my worldview. Motivated by an inherent curiosity, education emerged as an escape route and a foundation, guiding me toward teaching opportunities domestically and internationally. After completing my bachelor's degree in Pennsylvania, my career path took an unexpected turn when my role as an English teacher trainer in Colombia was terminated by the COVID-19 pandemic, leading to my relocation to Austin, Texas, as a Bilingual Kindergarten teacher. While traumatic, this sudden transition deepened my engagement with international education policy. My experiences in Colombia and Texas profoundly illustrated education's transformative power in shaping communities, families, and societal structures. Yet, I could not have anticipated how these experiences would leave enduring psychological imprints that would resurface after in my doctoral program with Maha.

In my hometown, hidden between a valley of mountains, my family and I have experienced occasional flooding, but nothing to the extent of what I had faced during my time as a teacher in the Great Texas Freeze of 2021. My move to Texas was a transformative experience, though not in the ways I had imagined. It reshaped my understanding of environmental challenges and the role education plays in times of crisis. This encounter with environmental instability opened my eyes to the importance of climate-just education.

Austin is inland and surrounded by rolling hills separated by the Colorado River, making it a great place for outdoor activities. As it was my first year as a classroom teacher in the United States, these opportunities to engage with nature helped me get through the tough days. Austin has a humid subtropical climate under the Köppen Climate Classification, having long, hot summers and mild winters, with warm spring

and fall transitional periods (National Weather Service, n.d.). Mild winters would indicate temperatures ranging from 41°F to 62°F (5°C to 17°C).

Nearly 50 percent of the population identify as White (non-Hispanic), while individuals from other racial and ethnic backgrounds—Hispanic, Asian, Black, or African American—made up a smaller share. This disparity becomes more visible in the city's zoning and gentrification patterns, which push minority communities to the margins. The North and Southeast zones of Austin are not far from the city center, where one finds a smaller percentage of its residents making ends meet. I lived and taught in the Northeast part of Austin, alongside my students and their families.

In Texas, electricity runs through a unique system overseen by ERCOT, an independent operator whose intrastate grid is disconnected from the two major North American grids. But in February 2021, this model was tested. A polar vortex descended from the North Pole starting on February 10, 2021, pushing arctic air into Texas and locking the state in record-breaking cold temperatures. Texas's infrastructure, unprepared for this level of cold, ice, and snow, had to endure the worst, leading to road closures isolating communities and major accidents piling up across highways. As temperatures plummeted, the electric grid broke down and left almost 10 million people in the dark, including me. The North and Southeast parts of Austin were without power for almost five days. The storm's after-effects lasted two weeks. The scene felt apocalyptic—neighborhoods fell into a pitch-black silence, grocery shelves emptied quickly, and bursting pipes flooded homes. Nearly 300 deaths were reported, though many believe this number underestimates the loss.

While the city highlighted the devastating financial toll, which resulted in billions of dollars in damages, the emotional toll was much more severe. Texans faced the aftermath largely on their own, with little systemic or educational response to support those who suffered. The Great Texas Freeze left physical and emotional scars, some of which are still apparent to this day.

After losing power on that brutal Wednesday afternoon, I remember the growing fear I had as I lay my head on my cold pillow in a pitch-black room that night. The next day, we were still without power when the panic set in. School was canceled because the roads were impassable, and the school was still without power. The administration created group chats and urged all teachers to communicate with their students' families and stay in contact with them for the unforeseen end of this tragedy. The stress was creeping up on me as I felt this pressure to support and absorb the anxieties of the 21 families I supervised, though I did not know where I was going next.

On day three of the Great Texas Freeze, the pipes burst in my apartment, flooding our bedrooms and bathrooms and making it no longer habitable. I packed my bags and headed south towards a hotel with a friend. It felt like I had entered a parallel universe. How could it be possible that the families in my school were suffering while others had

access to luxurious lives in a time of crisis and with a complete disregard for the reality of those only fifteen minutes north of them? Inequities were clearer than ever.

The following Monday, it was business as usual, though I was filled with uncertainty. I remember my frustrations with the school district. They were forcing us to require virtual classes on Monday because many of my students were without power. It added unnecessary stress and burden to families to try and connect their children to a Zoom class or complete the asynchronous assignments. We faced unprecedented challenges, and while I felt the weight of my struggles, I recognized the collective burden we shared. We were learning to adapt and support one another amidst the chaos, reminding ourselves that even in the darkest moments, we could find strength in our community and a commitment to our students' well-being.

This experience exemplifies the power of collaborative autoethnography as a healing pedagogy. For four years, my body held on to that fear, anxiety, and guilt. My emotions caught on, and it was time to let them go and process it. Sharing and reflecting on this vulnerable and personal experience with Maha, I found strength and empowerment in emotional release.

Connecting Across Experiences and Healing

Maha Shoaib. As my co-author and I opened up about our journeys over the next few days, I was struck by how deeply our emotions mirrored each other's. Despite living on opposite sides of the world and facing different disasters, we both carried the weight of fear, anxiety, and uncertainty—a reminder that these feelings transcend borders. As a student, I had expected my teachers to have the answers and to offer unwavering support. Hearing my colleague's perspective as a teacher during a crisis revealed how unsupported educators often are. She felt overwhelmed by the expectations placed on her to care for her students while having no resources to help them, or herself navigate the emotional toll of the disaster. This conversation was eye-opening for me. It made me realize how much I had assumed, as an 8-year-old, that adults always knew what to do. Teachers were trying to navigate the chaos without any clear guidance.

Our conversations felt profoundly therapeutic. Back then, I never talked about how scared I was. I buried my fear, pushing through the pressure to perform well academically. Every aftershock heightened my anxiety, and every news report brought a new wave of fear. I remember the images of Margalla Towers—a massive building in Islamabad—collapsing into rubble, with people frantically searching for their loved ones. Families gathered in large, open spaces like F-9 Park, bringing food, water, and prayer mats, hoping they would be safer outside if the ground shook again.

At school, my classmates and I would discuss the unfolding news during breaks, processing the fear and grief in fragments. But once the bell rang, we were expected to return to class as if nothing had changed. There were no conversations led by teachers, no counselors, and no check-ins. It was as though the emotional trauma we were experiencing didn't exist. We were left to carry the burden alone. The situation was worse for children from low-income communities, where resources were scarce, and many schools remained closed for extended periods.

Talking with my co-author made me realize how crucial it is to create spaces where people can share their stories without fear of judgment. It gave me a sense of closure I did not know I needed. I could revisit that 8-year-old version of myself and feel seen. I now understand how essential it is—whether as students, teachers, or community members—to have systems that address not just the physical impacts of disasters but the emotional ones. Mental health support, open conversations, and empathy are universal needs that should be prioritized.

I feel fortunate to have shared my story with my colleague, who listened with compassion and understanding. I extend my gratitude to her. This experience was a reminder that no matter where we are in the world, we need support. The simple act of listening to someone's story can be a powerful first step towards healing.

Sarah Kistner. Listening to Maha's experience as a student during the earthquake opened my heart to the pains and suffering of my young students, whom I assume may have been experiencing similar yet different sentiments without the tools, language, or support to do so. I still feel great guilt and shame for not being able to be that support for them. However, I believe that is exactly what this reflective process is teaching me now. For many of my students, school was a way to get two free, warm meals that they may not be able to receive at home. It was a place for students to feel safe. When we were out of school for almost two weeks, students and families lost essential nutrition and an overall sense of safety, as well as social and peer connection time. Many of my students' families had just arrived in the United States from other countries, such as Honduras and Guatemala. Amidst the catastrophe, they were at risk of being even more isolated during the storm without proper support, information, and care.

While schools were shut down, students and families no longer had safe spaces to go, lacked resources, and did not have access to pertinent information, such as COVID-19 protocols, food distribution, changes in school schedules, or access to local news updates. A young child froze to death as their family did all they could to provide warmth in their home with the few fleece blankets they had. That child, our fellow community member, did not deserve to die. There were no words or statements made about this terrible and senseless loss of life to our school community. We pushed through business as usual to get students to grade level. It is hard to focus on far-fetched state standards when the community around you is grieving.

The Great Texas Freeze hit when students were facing steep levels of stress, anxiety, and depression due to the pandemic. As a teacher, I was instructed to fit a 30-minute social-emotional learning (SEL) exercise into my lesson plan daily. The mandatory SEL practice became another item on the checklist rather than a holistic practice embedded into my teaching. Teaching became forced and rushed to meet standards. I was becoming anxious that I was failing my students. I stayed up late, brought my work home, texted and called parents 24/7, and worked on the weekend to ensure my students were ready for first grade. While we were pushing through the rest of the year, the buildings were not equipped to host us. Broken pipes and flooding caused mold to flourish, which led to long-term health effects on young bodies. My school did not need to shut down completely, but students and families were anxious about coming back. We lacked proper ventilation. I extend my gratitude to Maha for being part of this healing process. Through this experience and new insights, I reached out to my former teachers in Austin and shared my story with them. Four years later, we took that time to reflect on those events and found new peace. Our conversation is a positive step towards a greater healing process for the school and community in Austin.

Reflection and Recommendations: Our Vision for Climate-Just Education

Our vision for a climate-just education system is rooted in shared experiences from two geographically distinct cities—Islamabad, Pakistan, and Austin, United States. Both contexts illustrate how disasters create cascading effects that go beyond immediate physical destruction. These events disrupt education, social stability, and emotional well-being. Marginalized communities bear the heaviest burden, highlighting the urgent need for transformative educational practices that can bridge the gap between disaster and healing. While education is vulnerable to disaster-related disruptions, it holds the potential to act as a force for resilience and renewal.

We envision an alternative education system—one that moves beyond traditional models and embraces holistic and contemplative approaches to learning. Instead of focusing solely on academic recovery in the aftermath of climate disasters, this system prioritizes emotional resilience, community connection, and well-being. Inner wisdom and insight are not peripheral but central to education. Engaging deeply with their lived experiences, students and teachers alike can cultivate a more meaningful understanding of self, others, and the world around them.

Education in this framework entails preparation for the uncertainties of climate change and a practice of building strength, adaptability, and emotional intelligence to face life's challenges with courage and compassion. At a systemic level, climate-just education should confront structural inequities that climate change exacerbates. While some

education systems are equipped to deliver a climate-informed curriculum that includes science and SEL, others are not. To address broader societal implications, schools should adopt a justice-focused approach—one that fosters constructive coping strategies and builds leadership skills to support a more inclusive and resilient future (UNESCO, 2021).

Equity is a core principle of climate-just education. Ensuring that students, especially those in underserved and climate-vulnerable communities, have access to the resources and curricula that empower them to engage with climate issues meaningfully and confidently. A crucial part of this transformation involves acknowledging and addressing collective and individual traumas. Restorative practices—like community-building circles—offer safe and supportive spaces where students and educators can process their emotions, strengthen relationships, and begin to heal. These practices create conditions for learning rooted in empathy, accountability, and trust.

School and Community-Level Approaches

Schools and communities should prioritize emotional and psychological recovery to ensure long-term resilience in the aftermath of environmental disasters and crises. Research shows that focusing on emotional healing, rather than rushing into academic recovery, leads to better learning outcomes and personal growth (Durlak et al., 2011). Schools can play a critical role in this recovery by fostering environments that encourage emotional expression, mutual support, and healing. Community-building circles allow students and teachers to share their experiences and rebuild relationships. This helps them process trauma, cultivate empathy, and strengthen social bonds, making schools a place for holistic recovery rather than just academic catch-up. Providing counseling services for students, parents, and community members ensures that emotional needs are met, promoting a smoother transition back to normalcy (Čitil Akyol, 2024).

Students and teachers experience emotional distress following a crisis. The lack of structured emotional support during these times can exacerbate the challenges faced. Schools should address this gap by integrating trauma-informed practices and school-based mental health services. Research indicates that trauma-informed approaches can significantly aid in the recovery process, helping students and teachers cope with the psychological impact of a crisis (Baweja et al., 2021). Providing mindfulness training, counseling services, and safe spaces where individuals can openly express their emotions creates a culture of mutual understanding and support within the school community (O'Toole et al., 2019). Such an approach ensures that emotional well-being is not an afterthought but a critical part of the recovery process.

In post-crisis environments, there is pressure to catch up on lost instructional time, but this can lead to burnout and emotional fatigue. When schools prioritize the mental and emotional health of students and teachers, they can support the rebuilding process, reducing the negative impacts of stress and trauma. This means allocating time for emotional healing, incorporating restorative practices in the classroom, and providing teachers with the necessary resources to address the emotional needs of their students.

Without such support, the focus on accelerated academic recovery can hinder the opportunity for genuine learning and growth.

Disaster preparedness should be integrated into school curricula across all grade levels. As disasters become more frequent due to climate change, students should develop the skills to navigate these challenges. Teaching climate resilience not only equips students with survival skills but enhances critical thinking, problem-solving, and adaptability, which are key in responding to future crises (Cohen, 2017). Schools can help students understand the importance of environmental conservation while simultaneously preparing them for the inevitable impacts of climate change. By embedding climate education into the curriculum, schools foster a generation of proactive individuals who are better equipped to face and address the challenges of the future.

Counseling services are vital in helping communities process the trauma caused by environmental disasters. These services can support parents, students, and community members in overcoming anxiety and grief, ensuring a smoother transition back to school and a healthier recovery process (Čitil Akyol, 2024). Given that the length of school closures after a natural disaster is often uncertain, accessible and professional counseling services can help families and communities cope with the emotional upheaval. Schools, with their established networks and resources, can serve as central hubs for these counseling services, offering critical support during the recovery phase. By addressing both the emotional and academic needs of students and their communities, schools can play a transformative role in healing and building resilience.

Individual-Level Strategies for Emotional Resilience

Climate-just education empowers students and teachers with the personal tools they need to build emotional resilience in the face of catastrophes. Emotional resilience is crucial for coping with the ongoing stresses that come with living through climate disasters, and both students and educators need strategies to navigate these challenges. Integrating mindfulness, restorative practices, and self-care techniques into daily routines, individuals can better manage stress, anxiety, and the trauma associated with climate change. These practices are not just beneficial for coping with immediate crises but for fostering long-term emotional well-being (Gonzalez et al., 2020).

Mindfulness practices like meditation, breathing exercises, and self-reflection help individuals remain grounded in the present moment, which is essential when facing overwhelming challenges. Incorporating these practices into the school day, students and teachers can build the resilience needed to weather difficult emotional states. Restorative practices, like the Butterfly Hug or Emotional Freedom Technique (EFT), offer simple yet powerful tools for regulating emotions and processing trauma. The

Butterfly Hug is a grounding technique that promotes emotional safety and helps calm the nervous system, making it particularly useful for individuals who may feel overwhelmed. EFT, or tapping, involves using acupressure points to release stress and reframe negative emotions, helping individuals regain emotional balance during times of crisis. These techniques provide immediate relief from emotional distress and can be used by students and teachers to maintain emotional equilibrium (Davis & Hayes, 2011).

Yoga and Yoga Nidra are valuable practices for building emotional resilience. These techniques help individuals relax, release tension, and cultivate a sense of inner peace. Yoga encourages physical movement and breathwork, both of which are essential for managing stress and anxiety. Yoga Nidra, a form of guided meditation, helps individuals reach a state of deep relaxation and emotional healing, allowing them to process difficult emotions and experiences. Schools should consider integrating these practices into daily routines to help students and teachers manage the emotional challenges associated with climate change (Johnson et al., 2020).

Creative outlets like art therapy offer ways to express and process emotions nonverbally. Art therapy allows students and teachers to explore feelings through visual expression. It is a therapeutic release for emotions that are difficult to articulate. Engaging in creative activities can serve as a form of community-building. It encourages collaboration and shared expression within the school. Schools should incorporate creative practices into the curriculum, giving students space to reflect on their experiences and express their emotions in a supportive, non-judgmental environment (Malchiodi, 2012).

Conclusion

We explored how educational systems can serve as spaces for emotional and psychological healing in the aftermath of disasters. We discussed transformations that could enable education to function not just as a site of knowledge, but as a force for climate justice and collective healing. Through collaborative autoethnography, we examined how this process can support personal and communal healing of trauma across different global contexts. By grounding our research in contemplative inquiry, lived experience, and critical reflection, we position this paper at the intersection of climate justice, trauma-informed education, and transnational solidarity.

We highlight the importance of including marginalized voices and knowledge systems in dominant educational policy discourses. Despite increasing global concern around climate change, these voices remain excluded from climate knowledge production and decision-making. Our approach offers a comparative lens that interrogates the relational and affective dimensions of climate trauma and justice, allowing us to reflect on the broader educational systems we inhabit and seek to transform. We reimagine educational spaces as places of healing, transformation, and justice.

Looking toward the future, we see the weight that disasters place on the hearts of young people, schools, and communities. Despite these challenges, we believe in the power of a climate-just education, one that does not merely endure the harsh impacts of crises but learns and grows from them. Our vision, *Bridging Worlds and Healing Scars*, goes beyond preparedness. It is about cultivating resilience, fostering deep emotional connections, and strengthening communities. We envision students who learn to navigate life with courage, empathy, and a sense of purpose. We see teachers and families whose well-being is valued and prioritized, creating a foundation for true collective healing.

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Evaluation of the Impact of the 1.5 MAX Initiative on Climate Change Education (CCE) in Malawi Secondary Schools: An Education for Sustainable Development Framework Approach

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This qualitative case study evaluates the impact of the 1.5 MAX initiative on Climate Change Education (CCE) in Malawian secondary schools through the dual lens of Education for Sustainable Development and decolonial theory. Malawi's curricula prioritize Western agricultural models over Indigenous knowledge, resulting in fragmented implementation due to teacher training gaps, resource shortages, and a stark divide between students' climate knowledge and actionable engagement. While the 1.5 MAX initiative enhances climate awareness and practical skills through interactive methods, its effectiveness is constrained by limited teacher preparedness, curricular misalignment, and systemic resource limitations. The research highlights the importance of integrating Indigenous knowledge and adapting content to local contexts for greater relevance and effectiveness. By applying a decolonial lens, this research critiques the dominance of Western epistemologies in global educational initiatives and advocates for the co-creation of knowledge that centers local agency and context-specific solutions. While demonstrating the potential of international educational initiatives to complement local curricula, the study underscores the need for sustainable support systems and expanded teacher training. Future research should assess the long-term impacts of such interventions and explore strategies for aligning global practices with local needs, while dismantling colonial legacies to foster a more equitable and inclusive educational landscape.

Keywords: Climate change education, Education for sustainable development, decolonial framework, Malawi, 1.5 MAX initiative, teaching and learning support.

Introduction

Climate change is one of humanity's most pressing challenges, spanning across ecological, economic, political, and social scales (Anderson, 2012; Gardiner, 2011). These impacts are acute in Malawi, a landlocked country in southeastern Africa whose vulnerability stems from its heavy reliance on rain-fed agriculture and systemic limitations in adaptive capacity (Ziervogel et al., 2014). Ranked among the five countries most affected by climate change in East Africa (World Bank Group, 2022), Malawi contends with recurrent climate-driven disasters—including floods,

droughts, and tropical storms—that destabilize livelihoods, displace communities, and strain an already fragile economy. Over 80 percent of the population depends on subsistence agriculture compounding this vulnerability, and leaving food security and household incomes acutely exposed to erratic weather patterns (Nangoma, 2007). Prolonged droughts devastate maize crops, which are a vital economic and food resource in Malawi (World Food Programme, 2024). Deforestation exacerbates climatic challenges, as 95 percent of households depend on wood or charcoal for fuel (World Bank, 2022).

Addressing climate change-induced disruption requires technological and financial solutions as well asstructural, cultural, and behavioral reforms (Hoffman, 2010; Liverani, 2009). Education plays a critical role in fostering these changes (Wals & Benavot, 2017). The United Nations (UN)' Sustainable Development Goal (SDG) 13 (Climate Action) underscores education's importance in mitigating climate change impacts, fostering adaptability, and promoting sustainable development (UN, 2015). The United Nations Educational, Scientific and Cultural Organization (UNESCO) (2022) highlights that climate change education (CCE) can enhance individual and community resilience while driving societal transformation. Other research shows that educated populations are better equipped for sustainable behaviors and climate innovations (Piao & Managi, 2023).

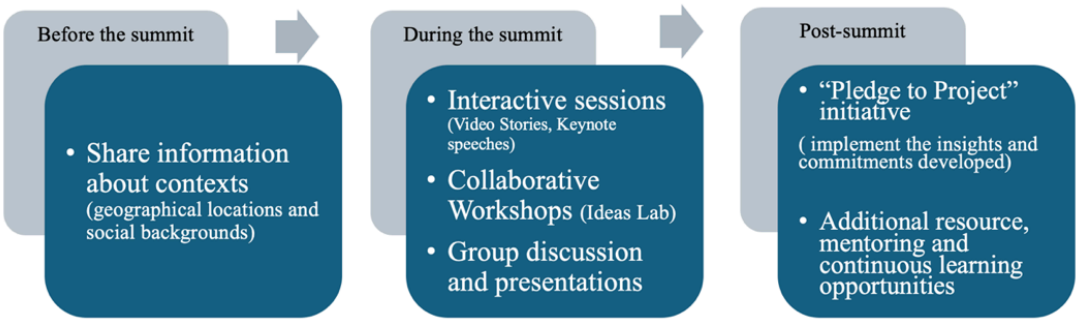
CCE in Malawi

The Malawian government has prioritized CCE since the 1986 African Ministerial Environment Conference, at which time the government integrated it into educational systems (Nampota, 2011). Recent efforts include the revised Climate Change Learning Strategy (Malawi Government, 2021), aimed at implementing a nationwide comprehensive CCE approach. However, gaps remain, such as limited integration of climate change topics across certain grades and subjects including primary, secondary and universities with different stratigies (Malawi Government, 2004; Mataya et al., 2020). International organizations, including the World Bank Group and the UN Development Program (UNDP)recognize these gaps and have taken measures to address them through projects like TRANSFORM and Ripple Africa, which enhance community resilience and conservation education (Ripple Africa, 2024; World Bank Group, 2022).

One initiative addressing these gaps is the 1.5 MAX initiative, launched in 2021 by Sustainable Partnerships, Learning for Sustainability Scotland, and the British Council (1.5 MAX, n.d.). This international program connects schools in Scotland with those in climate-vulnerable countries like Malawi and Nepal, fostering equitable and inclusive collaboration on addressing climate-related challenges. In Malawi, where extreme weather events such as cyclones, floods, and droughts pose recurring challenges, the summit emphasizes the urgent need for climate education and youth-led adaptation. This initiative (see Figure 1) combines in-class and online activities. Guided by local teachers, students identify local climate challenges and present their solutions online to global teams. These presentations are evaluated and guided by global professors, fostering a rich exchange of knowledge and strategies

(1.5 MAX, n.d.). After, schools implement community-based projects, empowering students and educators to contribute to local climate resilience and sustainability.

Figure 1
1.5 MAX initiative process



Note. Author's elaboration, based on 1.5 MAX Website (1.5 MAX, n.d.)

Having operated since 2021, the 1.5 MAX initiative provides a valuable opportunity to assess the impact of a climate initiative on CCE in Malawi and to identify future challenges. Building on this context, this paper evaluates the effectiveness of the 1.5 MAX initiative in enhancing CCE in Malawi's schools using an Education for Sustainable Development (ESD) framework. The study addressed the following questions: How does the 1.5 MAX initiative affect CCE in Malawi's secondary schools from educators' and students' perspectives? And w hat are the implications for future CCE enhancement in Malawi's secondary schools?

Literature Review

The notions of Climate Change Education and Education for Sustainable Development provide the foundational framework for this study.

CCE and ESD

CCE is critical for fostering resilience and societal transformation, yet its implementation faces barriers, including inconsistent teaching objectives, cultural and ideological resistance, outdated pedagogical methods, and community skepticism (Kolleck et al., 2017; Monroe et al., 2013; Nayan et al., 2020). The implementation of CCE has yet to meet urgent needs with unclear definitions and inconsistent methods (Fernandez et al., 2014; Nambiar & Sarabhai, 2015). While efforts to define its core skills and competencies exist (Mochizuki & Bryan, 2015), consensus on effective approaches remains elusive (Bushell et al., 2017). To address these challenges, scholars emphasize the need for strategies that prioritize student-centered learning and personally relevant content, ensuring climate education resonates with learners' lived experiences and motivates actionable engagement (Monroe et al., 2019).

These principles align closely with the broader goals of ESD—a framework rooted in the 1977 Tbilisi Declaration and refined through initiatives like Agenda 21 (UN, 1992)

and UNESCO's Decade of Education for Sustainable Development (2005–2015). ESD integrates environmental, economic, and social dimensions of sustainability (Corney & Reid, 2007), aiming to empower individuals and institutions through knowledge, skills, and values (Molthan-Hill et al., 2019; Pauw et al., 2015). It promotes values-based education (Dahl, 2012), critical thinking (Stevenson, 2007), and cognitive development (Sterling, 2011). Recent adaptations like ESD 2023 stress actionable and localized education for achieving the Sustainable Development Goals (SDGs) (UNESCO, 2020). ESD serves as a strategy to evaluate educational impact of CCE, emphasizing tangible outcomes like emission reductions and enhanced sustainable actions (Barth & Michelsen, 2013; Kioupi & Voulvoulis, 2019).

The United Nations emphasizes the need to empower societies through education, training, and collaboration (United Nations Climate Change, 2023). Mochizuki and Bryan (2015) focus on integrating climate themes into curricula to foster knowledge and behavioral change. This study adopts the latter definition, which highlights emotional well-being as central to behavioral change. By bridging CCE's practical challenges with ESD's systemic approach, these insights provide theoretical grounding for evaluating programs like the 1.5 MAX initiative and underscore the necessity for integrated, context-sensitive educational strategies to drive meaningful climate action.

In this paper, ESD functions as an assessment tool to evaluate the 1.5 MAX initiative within the Climate Change Education for Sustainable Development (CCESD) framework proposed by Mochizuki and Bryan (2015).

Integrate CCE within ESD

ESD addresses sustainability across social, economic, and environmental dimensions, while CCE specifically targets climate adaptation and mitigation (Mochizuki & Bryan, 2015). Mochizuki and Bryan (2015, p. 9) argue that because "CC encompasses environmental, political, social, and economic factors, the holistic framework of ESD is an optimal framework to advance CCE." This integration is critical because ESD encompasses climate–related knowledge and cultivates critical thinking and problem-solving abilities, and sustainable living behaviors (Anderson, 2012; Thomas, 2009; UNESCO, 2011). ESD emphasizes the institutional context in which this education occurs, ensuring that educational environments are resilient and proactive in promoting sustainable development (UNESCO, 2020).

By embedding CCE into ESD, learners may acquire a comprehensive understanding of climate change drivers, impacts, and solutions. Desha and Hargroves (2011) claim that this approach enhances climate literacy while empowering learners to share adaptation and mitigation strategies within their communities (Laurie et al., 2016; Schreiner et al., 2005). ESD leverages the multiplier effect of education, enabling learners to extend the benefits of their knowledge to their entire families and communities (Kioupi & Voulvoulis, 2019; Oranga et al., 2023). What is more, Lozano et al. (2022) show that ESD teaching methods improve skills and knowledge related to Climate Change and trigger positive emotions within students.

Empirical studies demonstrate the tangible impacts of integrating CCE with ESD. Pauw and colleagues (2015) present direct evidence of the positive effects of ESD, showcasing its capacity to foster students' awareness and behaviors of sustainability. These outcomes are amplified through models like the whole-school approach, which fosters student engagement and institutional sustainability (Davis, 2006). However, challenges persist. Kopnina (2014) critiques ESD's broad scope for diluting ecological priorities, risking ambiguous interpretations that may overshadow climate urgency. Uneven implementation—driven by insufficient teacher training, lagging curriculum updates, and weak policy support—undermines ESD's potential in regions like Africa (Manteaw, 2012; UNESCO, 2020; Vare & Scott, 2007).

Contextual Framework: Curricular Gaps and Student Engagement in Malawi

Malawi's CCE curricula reflect a tension between international influence and local realities. While supported by global stakeholders like USAID, educational content remains shaped by colonial legacies that prioritize utilitarian, human-centric narratives, oversimplifying environmental issues and disproportionately assigning responsibility to rural communities over systemic actors (Gyamera & Burke, 2018; Ress et al., 2022). Indigenous Knowledge—despite its proven efficacy in climate adaptation (Attoh et al., 2021), remains underutilized in Malawi's CCE. The agriculture curriculum promotes large-scale production systems reliant on synthetic fertilizers and pesticides, which contribute to soil degradation and water pollution. Although Malawi's Climate Change Learning Strategy (2021) expands CCE into formal and informal sectors, implementation is hindered by fragmented curricula, resource shortages, and uneven teacher training (Nampota, 2011).

These structural gaps correlate with stark disparities in student outcomes. Only 43.1% of Malawian secondary students demonstrate basic climate literacy, while 66.9% report no participation in mitigation activities like waste management or drought-resistant farming (Kutywayo et al., 2022; Wadson et al., 2023). These gap mirror trends in neighboring countries (Kutywayo et al., 2022) and underscore the limitations of theoretical, classroom-centric approaches (Wadson et al., 2023).

Latent potential exists: 73.4 percent of students express heightened climate concern, and 70.3 percent seek actionable engagement (Wadson et al., 2023). Successful models like Egypt's Green Schools Initiative and New Zealand's Enviro-schools Programme demonstrate how integrating environmental education with practical applications enhances engagement and outcomes (Eames & Mardon, 2020; Okasha et al., 2016). These findings highlight the potential for CCE to harness students' awareness and willingness to act.

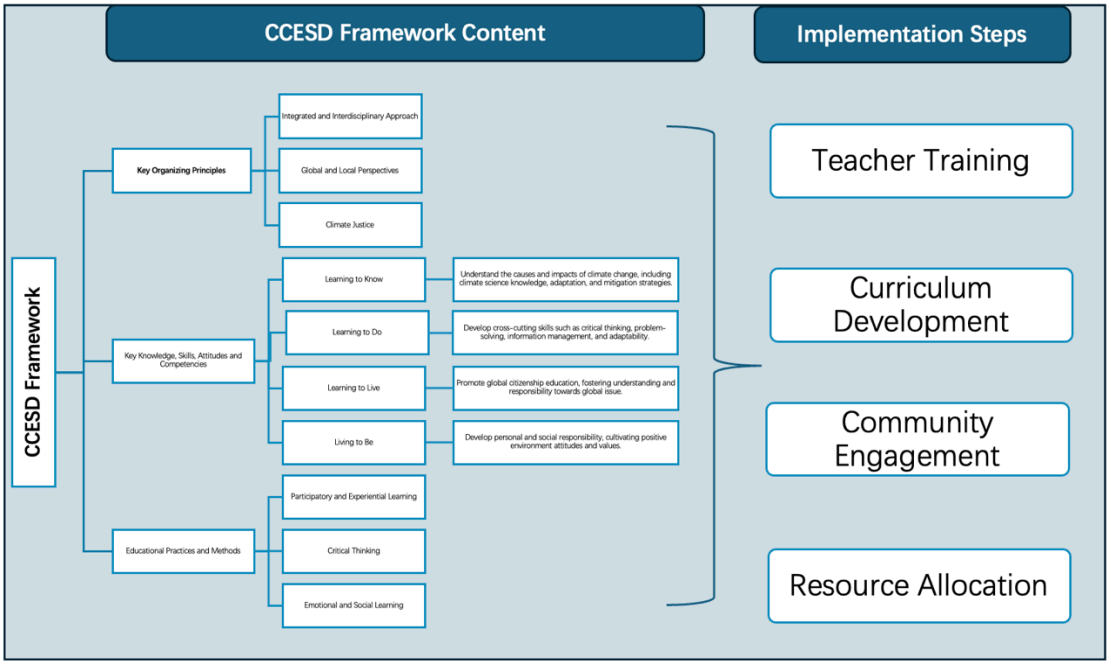
A Decolonial Lens for Evaluating CCE: Integrating CCESD and Mignolo's Framework

The CCESD framework (see Figure 2), developed by Mochizuki and Bryan (2015), provides a more detailed description of essential competencies. It extends beyond

imparting knowledge to developing the capability to transform this knowledge into actionable measures. The framework's emphasis on integrating local and Indigenous knowledge into CCE adds another layer of relevance, ensuring the education is culturally appropriate and enhances its effectiveness across different geographical and cultural contexts. The framework is structured around 4 pillars of learning outcomes (learning to know, to do, to live, and to be), making it pertinent for evaluating CCE interventions, such as the 1.5 MAX initiative.

Figure 2

Climate Change Education for Sustainable Development Framework



Note. Author's elaboration, based on Mochizuki and Bryan (2015).

The CCESD framework offers a practical structure for evaluating competencies and learning outcomes, incorporating the decolonial framework built by Mignolo (2007), which provides a critical lens to examine the systemic power dynamics and epistemological biases underlying CCE (Zavala, 2016). The concepts of coloniality of power, knowledge, and critique of global education initiatives, such as 1.5 MAX, may inadvertently perpetuate Eurocentric narratives while marginalizing Indigenous perspectives (Seroto, 2018). By combining CCESD's emphasis on competencies with decolonial critique, this study adopts a dual framework that evaluates the content and context of CCE interventions.

Data and Methodology

This study employs a multi-case evaluative design to address the complexities of the 1.5 MAX intervention, enabling diverse data collection methods, including in-depth interviews with teachers and students and systematic policy analysis. The inclusion of multiple cases provides comparative insights and enhances the generalizability of findings within Malawi's educational context (Patton, 2014).

Policy Analysis

To accurately assess the effectiveness of the 1.5 MAX initiative in Malawi, it is crucial to possess an in-depth understanding of the existing CCE within the country. Policy documents provide valuable insights into historical and educational contexts. As Mason (2017) asserts, documents are "constructed in particular contexts, by particular people, with particular purposes, and with consequences – intended and unintended" (p. 110); rendering them as key resources for providing background information on a research environment (Silverman, 2005).

To ensure relevance and reliability, a criterion sampling method was used to select documents aligned with Scott's (2014) quality criteria. The selected documents had to be officially issued by the Malawi Government or the Malawi Institute of Education (MIE), published within the last decade, and explicitly reference climate education. The following three key documents were analyzed: The Malawi Institute of Education (MIE) Strategic Plan 2020 to 2025: Focuses on enhancing curriculum design and evaluation, emphasizing CCE-related aspects (MIE, 2023), and the Syllabus (2013) from the Ministry of Education of Geography: Details curriculum content and pedagogical approaches for CCE, highlighting expected learning outcomes at various levels.

Interviews

Interviews are crucial for understanding individual experiences and the broader contexts in which they occur (Seidman, 2006). They facilitate researchers to construct a relatively comprehensive picture of the communities and cultures involved (Holstein & Gubrium, 1995; Powney & Watts, 2018). For this research, semi-structured interviews were conducted to gather insights into educators' and students' perceptions of the 1.5 MAX initiative.

Purposive sampling was used to select four schools, Community Day Secondary Schools and private schools, from diverse regions such as Blantyre in the south and Karonga in the north (see Figures 3 and 4). Teachers directly involved in the initiative were interviewed, and snowball sampling was used to select participating students (Marcus et al., 2017). In total, eight interviews were conducted, each lasting about 40 minutes and covering 10 structured questions based on the CCESD framework. Additional probes were used to deepen the dialogue. All interviews were audio-recorded with participants' consent and subsequently transcribed.

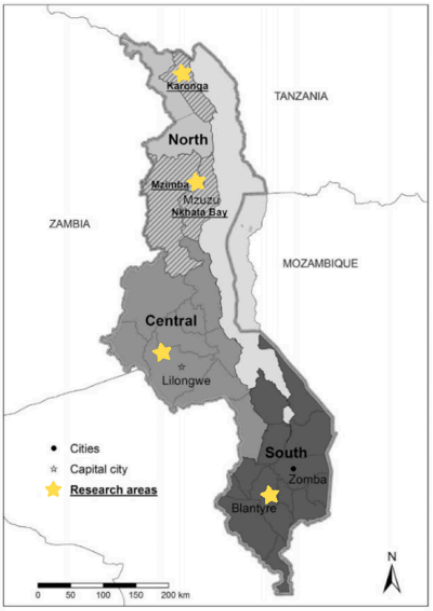
Figure 3

List of participants

Name	Gender	Location	Role/Academic Level	Year in Program
Teacher1- T1	Male	Mzuzu	Head of Science Department	Second Year
Teacher2 - T2	Male	Karonga	Physics and Chemistry Teacher	Second Year
Teacher3 - T3	Male	Blantyre	Physics Teacher	First Year
Teacher4 - T4	Female	Kasungu	Physics Teacher Climate Activist	Second Year
Student1 - S1	Male	Mzuzu	Form 2	First Year
Student2 - S2	Female	Kasungu	Form 4	Second Year
Student3 - S3	Male	Karonga	Form3	Second Year
Student4 - S4	Female	Blantyre	Form 4	First Year

Figure 4

Research area in Malawi



Note. Author's elaboration, based on the Malawi Spatial Data portal MASDAP (2012).

Data Analysis: Reflexive Thematic Analysis

I employed reflexive thematic analysis (RTA), emphasizing the researcher's reflective engagement with the data (Braun & Clarke, 2019, p. 594). This flexible approach incorporates deductive and inductive coding strategies. This analysis adhered to a systematic six-phase approach (Barth & Michelsen, 2013; Braun & Clarke, 2021), beginning with familiarization and systematic coding. The CCESD framework guided my deductive coding (Mochizuki & Bryan, 2015), establishing foundational themes linked to its dimensions (e.g., Learning to Know) (see Figure 5).

Figure 5

Deductive codes

Framework Dimension	Evaluation Themes in CCESD	Linked Themes in Research	Foundational Code
Learning to know	Knowledge of Climate Science	Teacher/student initial understanding about CCE and ESD	Understand simple climate issues
			Analyse climate patterns and effects
			Engage in complex climate modeling and predictions
	Mitigation and Sustainable Consumption	Adaptation and Mitigation Strategies	Basic Recycling and Conservation
			Sustainable Lifestyle Practices
			High-Impact Mitigation Strategies
	Adaptation and Disaster Risk Reduction (DRR)	Climate Awareness and Problem Identification	Understand personal and local preparedness
			Community-Based Adaptation Strategies
			Systems-Level Resilience
	Knowledge of Local Conditions	Curriculum Related to Local Context	Recognize local climate issues
			Assess the impact of local activities
			Manage and mitigate local challenges

Note. The author's elaboration is based on the CCESD framework.

Inductive coding allows for the emergence of new themes or refined sub-themes not initially anticipated by the framework (Figure 6). Subsequent steps include refining these themes to ensure they accurately represent the dataset and compiling a comprehensive report that integrates the findings and discussion.

Figure 6

Inductive Codes

Evaluation Themes in CCESD	Themes in Research	Code	Transcript
Knowledge of Climate Science	Teacher initial understanding about CCE and ESD	Understand simple climate issues	"When looking at education for sustainable development, we aim to impart knowledge to our students on how to sustain the biodiversity of the earth" (T4).
			"I understand that we have climate change" (T2). "It's about how to mitigate or adapt to these changes" (T4).
			"the importance of education in imparting crucial knowledge about climate change" (T3).
		Difficulty in Defining Objectives	"It's difficult to define specific objectives for climate change education unless the school has an organization or society that focuses on this"(T1).
		Analyse climate patterns and effects	"We aim to impart knowledge to students about the effects of climate change" (T4). "We focus on the impact of human activities on the environment" (T2).
		Engage in complex climate modeling and predictions	N/A
		Recognizing the importance of CCE and ESD in the curriculum	"Education for sustainable development ensures that all aspects in different subjects are interconnected" (T3). "This type of education equips learners with knowledge for sustainability" (T1).

Note. Analysis based on deductive codes and interview data.

Analytical Framework

The CCESD framework employs the four pillars (as shown in Figure 3) defined in the Delors (1996) Report about the education capacities for the 21st Century (Mochizuki & Bryan, 2015). This study will specifically concentrate on two fundamental aspects: Learning to Know and Learning to Do. In the **Learning to Know** pillar, learners should acquire an adequate understanding of the origins and consequences of CC, alongside the necessary tools for mitigation and adaptation. In the **Learning to Do** pillar, students should acquire interdisciplinary skills, such as emotional intelligence to handle anxiety, adaptability to different contexts and educational settings, understanding of complex system dynamics, and the ability to envisage alternative futures and solutions.

Results and Discussion

This section analyzes how the 1.5 MAX initiative influences CCE in Malawi through the CCESD framework. Based on policy documents and interviews, it explores the initiative's impact on learning outcomes.

Learning Outcomes: Learning to Know

An analysis of the interview data and curriculum syllabus found that students and teachers in Malawi possess a superficial understanding of climate change-related knowledge. Teachers admitted, "they didn't have the idea about the mitigation and adaptation before they joined in this activity" (T2). This ambiguity extends to students' responses, indicating a general but unclear understanding of the terms. When asked about their comprehension of CCE, teachers responded:

> When looking at climate change, we aim to impart knowledge to our students on how to sustain the biodiversity of the earth (T1).
>
> I understand that we have climate change (T2).
>
> The importance of education is imparting crucial knowledge about climate change (T3).
>
> A way of teaching students how they can conceive the problem and how students can be aware of the issues concerning the environment (T4).

Students were asked about the idea of mitigation and adaptation. They responded:

> I feel I do have that idea (S2).
>
> The main strategies that have come across are planting trees and proper waste management. It involves adopting a mindset to change the future and helps in controlling climate change in our schools (S3).

Research undertaken by Wadson et al. (2023) highlights a similar educational shortfall, pinpointing specific deficiencies in knowledge among senior secondary school students in Malawi. Similarly, Falaye and Okwilagwe (2016) found low levels of knowledge about CC mitigation and adaptation in Nigerian secondary schools, with students unable to differentiate between these two terms.

Figure 7

Sustainable Development element in the syllabus

Core Element	Form 1	Form 3	Form 4
Sustainable development	Socio-economic development • Family needs and resource management	Types of development • Political development • Social development • Economic development	Sustainable development • Meaning • Importance • Conditions for sustainable development • National and international sustainable development initiatives

Note. The Geography Syllabus (2013) was disseminated among the educators interviewed for this study.

This finding is crucial because mitigation and adaptation are essential components of CCE. Despite the secondary education outcomes in the overview of the secondary syllabus, which indicate that students should 'demonstrate the ability to adapt to climate change and mitigate its impact on the economy and environment' (Social Studies Syllabus, p. ix), the lack of explicit curriculum requirements has resulted in these vital aspects being overlooked in teaching. The Social Studies syllabus connects sustainable development with socio-economic and other types of development (Figure 7), emphasizing a prioritization of economic growth. This focus reflects aspirations in the Global South to achieve development, asserting their right to pursue such progress through education against a backdrop of historical marginalization, colonial exploitation, and ongoing neo-colonial influences in the post-colonial era (Singh, 2020; Tikly, 2019). However, the emphasis on economic growth in the curriculum reflects the coloniality of knowledge (Mignolo, 2007), where Western-centric development paradigms dominate, marginalizing Indigenous and local knowledge systems. The syllabus frames nature as a resource to be managed for human benefit, reinforcing a Eurocentric, anthropocentric worldview. This perspective perpetuates Descartes's dualism, separating humans from nature and prioritizing exploitation over ecological harmony (Mazzocchi, 2016).

The 1.5 MAX initiative has offered insights to students. Educators noted improvements in students' understanding of environmental issues, "Now they can understand these things, it helps them come up with solutions" (T4). Students' responses to CC questions demonstrated their grasp of the causal relationships in the local climate crisis, such as "When heavy rains come, people living by the lake are greatly affected. Floods cause many waterborne diseases" (S2). There is a variation in the depth of understanding across different topics. Compared to more complex systemic issues, students find it easier to understand direct impacts. Students perceive CC challenges as revolving around tree planting, stating that:

> We can protect the environment here. It's just about finding out how to get some tree seeds (S4).
>
> In the books, they just mention trees and say we shouldn't burn them (S1).
>
> They rely on the trees for their livelihood, so stopping them is challenging (S3).

The finding aligned with the UNESCO (2012) report entitled 'Education Sector Responses to Climate Change', that while CC concepts are present in the majority of curricula, the approach is superficial. The emphasis tends to be on individual actions, which overlooks the broader societal forces driving CC.

Engagement in the 1.5 MAX initiative has provided students with knowledge for CC adaptation and disaster risk reduction. This sharply contrasts with the findings of Kutywayo et al. (2022, p. 3), who reported that only 38.5 percent of learners in South Africa acknowledged that climate events such as heat exposure or droughts had

affected their lives. In Malawi, after attending the 1.5 MAX initiative, students could articulate the interplay between human actions and CC, a knowledge advancement aligning with Wadson et al.'s (2023a, p. 77) interpretation that "this may be a result of what the learners in Malawi are experiencing regarding the effects of CC."

Educators have highlighted a disconnect between classroom learning and community action, observing that "most students seem to forget what they learned in school" (T2). This observation aligns with the findings of Falaye and Okwilagwe (2016), who noted that a deep understanding of CC can influence learners' attitudes toward it. In response to this challenge, the 1.5 MAX activities are designed to prompt learners to directly engage with local environmental circumstances and their related hazards, such as flood management and sustainable agriculture methods. This approach encourages students to engage with themes directly relevant to their surroundings, successfully closing the divide between academic understanding and real-world implementation. The initiative's emphasis on community-based projects fosters locally driven solutions rather than imposing external frameworks (Mignolo, 2018; Sayre et al., 2017). As a result, students are better prepared to contribute meaningfully to the green economy and to a sustainable future (Affolderbach, 2020).

Learning Outcomes: Learning to Do

This research reveals that the 1.5 MAX initiative has had a significant impact on students' engagement with environmental actions. Students have not only become aware of the environmental issues discussed above but have actively engaged in devising solutions. This engagement has led to noticeable advancements in multiple skill areas, which are elaborated upon in the subsequent discussion. These skills are aligned within the CCESD framework; however, it is evident that certain areas within this framework are underrepresented in some schools.

The CCESD framework promotes the cultivation of diverse analytical skills amongst learners, equipping them to explore the multifaceted causes and dimensions of CC and to identify potential actions and consequences for addressing this complex issue (Mochizuki & Bryan, 2015). Interview data (Table 1) indicates that Malawian students enhanced certain key learning capabilities related to the CCESD framework (Mochizuki & Bryan, 2015) following their participation in the 1.5 MAX.

Participation in the initiative enhanced the students' communication skills. Students expressed increased confidence in their ability to communicate with others and learn from environmental practices. One student revealed, "I am confident in presenting and offering advice to people" (S2). Initiatives focused on sustainability can transform students into effective communicators and advocates (Wals, 2011).

Students demonstrated a shift in their ability to undertake individual and collective responsibilities in climate action. Participation in the 1.5 MAX initiative taught them about environmental issues and motivated them to propose their solutions (1.5 MAX, n.d.). An educator (T4) noted, "we are looking at the bigger picture as the government is adopting other solutions [...] but now with 1.5 MAX, they can propose

their own." However, it should not be concluded that this contradicts the findings of Wadson et al. (2023), reporting that most learners in Malawi did not participate in CC mitigation and adaptation practices. This may be because the students engaged in the 1.5 MAX initiative still represent a small proportion of the overall student population in schools, as evidenced by current participation:

> Currently, there are 38 students in the group, and the goal is for them to spread the knowledge to all their schoolmates (T3).
>
> This year the turnout was very good. I had 20-plus students. Everyone was very willing to attend, and everyone was very willing to continue attending such kinds of activities (T4).

Several challenges have been identified that affect wider student participation and engagement. A major factor frequently mentioned is the lack of available time for teachers, which impacts their ability to support these initiatives. This constraint is directly reflected in teacher feedback:

> One of them is time, it's because a teacher is too busy to help with this (T1).
>
> We need facilitation for specific tasks. Sometimes, instead of preparing what I am supposed to teach tomorrow, I end up preparing for the 1.5 Max initiative or attending meetings (T2).

Varying levels of student interest in climate action were observed, with many showing eagerness to join as teachers said: "It is surprising to find out some students lack interest in climate action" (T3). This disparity is compounded by skepticism from communities and students about the motives behind such initiatives.

> People often think we are trying to benefit personally. It's hard to convince them that we are doing this voluntarily (T3).
>
> They expect donations and find it difficult to believe. The main challenge is that my students may not have much interest in researching (T4).

This may stem from a disconnect between the curriculum and students' lived realities, a phenomenon associated with "epistemic disobedience" (Mignolo, 2011). By failing to ground climate education in students' immediate socio-economic and cultural contexts, the system reinforces alienation and skepticism, limiting the transformative potential of such programs (Rudiak-Gould, 2013).

Coping with the Emotional Realities

There is growing literature on climate anxiety, reflecting how profoundly the climate crisis impacts students' lives and emotions (Pihkala, 2022; Soutar & Wand, 2022). Emotional education is overlooked by Malawian educators. The research found that climate issues have exacerbated students' economic hardships in Malawi, rendering them unable to afford tuition and meet basic needs, thereby intensifying their

emotional distress. One teacher stated, "the students' emotions are affected [...] this week, most students were sent away due to school fees" (T4). Another teacher added, "the students are very worried... 'I came here on an empty stomach.' So, I cannot concentrate on my lessons" (T3). Struggling to meet basic needs like food, increases their emotional burden. These invisible wounds are evident in the teacher's interview: "this affects their lives, but it is the emotions that suffer. Sometimes they are not welcoming. Just like last time, a student almost cried" (T2).

Emotional challenges reveal the legacy of colonial systems that have left many Global South countries economically dependent and structurally marginalized (Ulus, 2014). The continued economic vulnerability, seen here in students' struggles with tuition and basic needs, is a symptom of a "colonial matrix of power" (Mignolo, 2023). This matrix perpetuates inequities by prioritizing neoliberal economic models that exacerbate inequalities, leaving students and communities unable to manage the compounded effects of climate change and economic hardships. During visits to schools, the researcher observed how the land that could have been used for cultivating crops to support local food security was allocated for cash crops like tobacco. This prioritization of cash crops over subsistence farming underscores the colonial legacy of economic structures that prioritize global market demands over local needs, entrenching the vulnerabilities of communities (Mwanika et al., 2020). By failing to address these systemic disparities, educational frameworks perpetuate a form of "epistemic violence," which disregards the emotional and psychological realities faced by learners in the Global South (Berry, 2008).

Educators, however, are not cognizant of the need to address the various emotions learners may experience, resulting in ineffective management of feelings of despair, helplessness, and guilt (Phillips, 2009). An educator admitted, "we didn't take care of the specific feelings, we did not" (T2). A basic awareness of students' welfare needs is crucial. A teacher expressed concern that, "this is another thing that as a teacher I should be worried about" (T4). However, considering the strong emotional impact on climate-related hazards, disasters, and future changes can have, it is essential to address the emotional well-being of learners (Lawrance et al., 2022).

Implications for the Future

This section extends analysis of the emerging themes from interviews, including challenges and support needs raised by participants in the final part of the interviews. The narratives from educators and students underscored the urgent need to enhance CCE in Malawi through teaching and learning support.

International Level

From an international perspective, initiatives such as the 1.5 MAX provide crucial support for CCE in Malawi by enriching the curriculum and enhancing student engagement with climate issues. Participation in such global projects helps students understand and address local and international climate challenges. However, ongoing follow-up is essential. Although the 1.5 MAX initiative has established

follow-up activities after each summit, teachers still emphasize the importance of continuous engagement. They advocate that:

> We need to share our progress and achievements at every summit, asking, "What have you done this year? How many activities have you planned?" (T2)

> The other part should be following up. If we have really started working on our projects (T1).

> More attention needs to be paid by the organization to ensure that this knowledge reaches a wider audience (T3).

Educators expressed concerns about the outdated nature of educational content: "The main issue should be to study the reasons for their continuous change. If we stick to one topic, over time it may become irrelevant" (T3). This highlights the need for updated curricula that adapt to evolving knowledge and conditions (Nurdin et al., 2017). This disconnect may arise because national curriculum revisions and updates typically occur over long cycles (Amanchukwu et al., 2015). This disconnect reflects the legacy of coloniality in knowledge systems. The reliance on rigid, globally standardized curricula risks sidelining local and Indigenous knowledge systems that are dynamic and rooted in the lived experiences of Malawian communities (Ezeanya-Esiobu, 2019; Shizha, 2010). Initiatives like 1.5 MAX must prioritize integrating local ways of knowing to ensure contextually relevant and equitable education (Muchenje, 2017; Quigley, 2009).

International support through supplementary reading materials and science books can help to bridge knowledge gaps. Interviews stress this need: "We don't have enough books. We don't have resources like articles about climate change," and "the resource we need is knowledge, especially in books" (T2). This stresses the critical gap in educational materials available to effectively teach and understand climate change. However, it is equally important that these resources are not solely Western-centric but include locally produced materials that reflect the cultural, ecological, and socio-economic realities of Malawi (Shizha, 2010; Quigley, 2009). Follow-up activities for international initiatives like 1.5 MAX could move beyond global dissemination to collaborative knowledge creation. By doing so, the initiative can evolve from a model of knowledge transfer to one of knowledge exchange.

National Level

At the national level, improving teacher training and evaluation mechanisms are key factors for the effective implementation of CCE (Branch et al., 2016; Malawi Government, 2012; Mavuso et al., 2022; Olawumi et al., 2023). According to Mavuso et al. (2022), the implementation of teacher capacitation programs has been shown to improve pedagogical practices by equipping teachers with the necessary content and pedagogical knowledge to integrate CCE into their lessons. Although the policies in

Malawi recognize these aspects as priorities (Malawi Government, 2011), there are deficiencies in teacher engagement and evaluation. At present, most teachers report not having participated in any official training. "No, I have never attended any training provided by the national level or any organization" (T1) is a common response from three teachers. This exposes a deficiency in the availability and delivery of professional development programs for educators. This is consistent with the study conducted among four hundred teachers in Malawi senior secondary schools by Wadson et al. (2023b), which revealed that 93.2% of teachers had never participated in any CCE training.

Many teachers were not adequately prepared to teach CCE courses at the senior secondary school level. In my research, only one teacher participated in an online ESD training provided by an American organization, and this training opportunity was obtained through private channels rather than official educational authorities. This situation reflects a serious deficiency in teacher training. The reliance on externally developed training resources—such as those from foreign organizations—reinforces global knowledge hierarchies that marginalize local expertise and Indigenous knowledge. Teacher training should instead be rooted in Malawi's sociocultural and environmental context, enabling educators to draw from local experiences and knowledge systems while engaging with global frameworks (Brayboy & Maughan, 2009; Kretzer, 2021).

Implementing a standardized teacher evaluation system could help regularly assess and enhance teaching practices. As the teachers expressed,

> We need specialists to work with us, not just to collaborate, but to provide in-depth knowledge. We hope they can visit our schools more frequently (T3).
>
> We need to share our progress and achievements at every summit, asking each other, 'What have you done this year? How many activities have you planned?' (T2).

This highlights the desire for more consistent and expert support in enhancing educational practices. Establishing a network of CCE educators to share best practices and resources would support this goal (Waldron et al., 2020). Teachers acknowledged, "The knowledge obtained should be shared with the right people, including other teachers and community members." This emphasizes the importance of collaborative learning and community involvement in spreading CCE. Sharing knowledge about CC is crucial for facilitating communication among teachers and strengthening a collective capacity to educate on this topic.

Community Level

Strengthening community participation and cooperation is essential for promoting inclusive CCE methods. Whilst the 1.5 MAX initiative has enhanced students' understanding of environmental issues and their involvement in seeking solutions, community engagement remains limited due to low awareness and financial

constraints. One interviewee (T2) highlighted education's role in community impact, stating, "the more we educate these pupils, the more these pupils will take information to their communities, and the more people will know". This indicates that whilst educational efforts are enriching student knowledge, their transmission to the broader community is insufficient. Funding shortages hinder community involvement. As one teacher (T4) mentioned, "they know how to plant trees, and they have the Indigenous knowledge, but they don't have trees. It's expensive to buy one tree". This indicates that whilst communities possess skills, financial resources for implementation are lacking (Piggott-McKellar et al., 2019).

Addressing the CC crisis increasingly depends on collaborative learning within communities (Ayers & Forsyth, 2009; Davies, 2012). In interviews, teachers expressed the need for greater community awareness, suggesting that "local involvement is a resource in itself, such as the Indigenous knowledge and the natural resources" (T3). This underscores the importance of re-centering local knowledge as an essential epistemic resource. Collaborative learning rooted in local practices enriches climate literacy and challenges the dominance of Western-centric knowledge systems, making education more inclusive and contextually relevant (Anderson, 2012; Mbah & Ezegwu, 2024). Engaging with nature and local communities equips learners with practical climate literacy skills unattainable in conventional classrooms (Orr, 1991). Activities like community gardening teach ecological skills and foster a sense of purpose and connection, as participants benefit from their efforts (Clavin, 2012).

Establishing strong partnerships between schools and communities is crucial in addressing the emotional and socio-economic challenges that students face (Roche & Strobach, 2019). While emotional issues are overlooked in classrooms, community activities like planting and harvesting offer engagement, sensory stimulation, and enjoyable learning experiences. Such interaction encourages 'biophilia[1]', a love for plants and wildlife (Wilson, 1986), fostering sustainable practices. In Malawi, where livelihoods are deeply tied to agriculture and natural resources, this connection to nature can promote sustainable agricultural methods and biodiversity conservation. In regions like Malawi, which face extreme weather events and high food prices, collaborative projects such as self-sustaining gardens equip students with practical tools to combat food insecurity and adapt to challenging conditions effectively.

This approach demonstrates that the health of the environment and the well-being of learners are interconnected (Ensor & Harvey, 2015). By actively participating in the community, learners can exercise their agency within these various constraints, shaping their future and the environment around them.

Conclusion

This paper has explored the impact of the 1.5 MAX initiative on CCE in Malawian secondary schools, addressing key research questions and highlighting implications

[1] Biophilia refers to "our innate tendency to focus upon life and life-like forms and, in some instances, to affiliate with them emotionally" (Wilson, 2003, p.134).

for future enhancements. The findings demonstrate that the initiative has positively influenced educators and students by fostering a multidisciplinary approach and interactive teaching methods. Educators observed increased student engagement, critical thinking, and problem-solving skills, while students reported a greater understanding of climate issues and expressed a need for more experiential learning opportunities.

Deeper structural and systemic challenges rooted in historical inequalities continue to shape educational frameworks in Malawi. The findings emphasize that the lingering "colonial matrix of power" perpetuates economic and epistemic dependencies, limiting the transformative potential of initiatives like the 1.5 MAX. The prioritization of neoliberal educational models and global market-driven solutions ignores local needs, cultural contexts, and Indigenous Knowledge. This epistemic marginalization constrains educators' capacity to localize CCE and adapt teaching methods to address global and local climate challenges.

To overcome these challenges, this study highlights several critical areas for improvement. Integrating Indigenous knowledge into the curriculum is not only essential for cultural relevance but also represents a vital step toward decolonizing knowledge systems within CCE. Embedding community-based projects that empower students to address local climate issues would foster practical, contextually relevant solutions while challenging colonial educational hierarchies. Second, teacher training programs must prioritize decolonial pedagogies that equip educators with the skills and confidence to navigate complex climate topics while acknowledging the lived realities of their students. Third, strengthening community engagement is vital to creating learning environments that blend local knowledge with global climate action frameworks. Such engagement ensures collaborative problem-solving and shared responsibility for climate resilience, rooted in local agency and self-determination. Finally, establishing feedback mechanisms to regularly evaluate and refine CCE strategies can help align educational objectives with the evolving goals of the ESD framework and the principles of decoloniality.

This research, as the first to apply the combined CCESD and decolonial frameworks to assess the 1.5 MAX initiative in Malawi, provides a novel methodological approach to evaluating climate-focused educational interventions. By integrating academic knowledge, practical applications, emotional education, and decolonial perspectives, the study underscores the necessity of a multidimensional and transformative strategy to prepare students for the challenges of a changing climate. It highlights the value of integrating hands-on projects, participatory teaching methods, and decolonial frameworks to guide the development of equitable and effective educational policies and practices.

Future research should build on these insights by prioritizing the evaluation of policy implementation and its impact on educational outcomes. Exploring innovative approaches to local and global collaboration, leveraging technology, and fostering public-private partnerships can amplify the reach and impact of CCE initiatives. Longitudinal studies are critical for understanding the sustained effects of these

strategies, enabling researchers to track behavioral changes and educational outcomes over time. Future inquiries should examine how decolonial frameworks can be operationalized within educational policy and practice to dismantle systemic inequities and epistemic dependencies.

This study has demonstrated the potential of the 1.5 MAX initiative to advance CCE in Malawi while exposing the structural and epistemic barriers that hinder its broader impact. Addressing these challenges through decolonial and ESD-informed strategies, educators and policymakers can work toward creating an education system that not only equips students with the knowledge and skills to tackle climate challenges but also empowers them to reclaim agency over their futures. This integrated and decolonial approach offers a pathway for Malawi and other Global South contexts to achieve equitable and sustainable climate education outcomes.

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Debojyoti Das *is an anthropologist and geographer by training with a research focus on the Global South and a strong commitment to sustainability education. With over ten years of experience in teaching, research, and academic scholarship in the United Kingdom higher education sector, Das has worked to embed sustainability principles into both curriculum design and student engagement. Das has designed and led summer schools, field trips, and interdisciplinary workshops that integrate critical pedagogy with sustainability themes, encouraging students to explore global and local challenges through multimedia projects and experiential learning. Das believes in practice-based, 'learning-by-doing' approaches, which have proven effective in deepening students' understanding of complex environmental, sustainability and development issues.*

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Rethinking Climate Change in Education: From Climate Coloniality to Decolonial Educational Ecologies in Comparative and International Education

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We present methods to examine the relationships between climate change and education while rethinking educational approaches that do not rely on endless economic growth, extraction, and accumulation through dispossession. At this historical moment, which is focused on transitions toward a greener future, it is essential to consider how the roles of those most affected by climate change are often overlooked in narratives about "climate solutions." The paper highlights what is absent from and erased within the United Nations Sustainable Development Goals and prevalent approaches to climate change education. It does so by focusing on a longer historical arc, as well as Black and Indigenous knowledge systems and cosmologies, alongside ongoing and historical injustices. Utilizing the framework of a decolonial educational ecology, we reimagine climate change in education within interconnected global contexts, emphasizing historically marginalized knowledge systems, confronting power imbalances, and creating alternative pathways toward more sustainable, just futures that transcend universal Western epistemic frameworks.

Keywords: Decolonial education ecology, Comparative and International Education, Climate Change Education, decolonization, climate coloniality.

Introduction

Scholars, policymakers, and practitioners worldwide have emphasized the importance of K-12 education, higher education, and informal education in responding to climate change in recent decades (United Nations [UN], 2021). Simultaneously, the epistemic foundations of the topic are often ignored. Popular models of climate education aim to provide students with an understanding of climate change, covering its causes, effects, and remedial strategies, such as transitions to "green energy" (Rousell & Cutter-Mackenzie-Knowles, 2020). This knowledge is assumed to enable students to respond effectively to climate-related challenges while promoting environmental stewardship and sustainable development. In curriculum and policy, climate education focuses on the scientific understanding of the mechanisms underlying changing atmospheric conditions, empowering students to reduce carbon emissions, and raising awareness of the impacts of intensifying weather patterns (Bhattacharya et al., 2020;

Stein, 2020; Stein et al., 2023). However, we argue that what is missing from how climate education is currently taught is a focus on discussing the longer interconnected historical arc of the past, explaining the erasures of Black and Indigenous knowledge systems and cosmologies (other ways of living and being in the world), and addressing historical injustices through reparative projects (Acabado & Kuan, 2021; Emeagwali & Shizha, 2016; Estes 2019; Scherrer et al., 2024). We put forth that such a reorientation in the way we teach about climate education allows us to re/center a multiplicity of 'pluriversal thinking' (Escobar, 2018) through what we call *decolonial educational ecologies* (discussed below). Building on Ferdinand (2021), a decolonial educational ecological approach involves more than just incorporating Black and Indigenous viewpoints. It requires reimagining education to center historically marginalized knowledge systems and cosmologies while confronting existing human and more-than-human power imbalances as humans seek to address the current climate crisis.

In the field of Comparative and International Education (CIE), the topic of climate change is commonly addressed through the framework of education for sustainable development (ESD). ESD is premised upon "development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs" (Gavrila, 2023, p. 47). ESD emerged as a global framework following the publication of the Brundtland Report (UN, 1987), which was released after the Decade of Education for Sustainable Development (2005-2014). When this occurred, climate education or climate change education became a top priority, highlighted by the UN and the UN Educational, Scientific, and Cultural Organization (UNESCO), which laid the groundwork for future initiatives during two major global events: Agenda 2030 and the UN Climate Conference in Paris. In September 2015, the United Nations adopted the 2030 Agenda, which codified 17 Sustainable Development Goals (SDGs). The three SDGs most pertinent to climate education are: ensuring access to affordable, reliable, sustainable and modern energy for all (SDG 7), taking urgent action to combat climate change and its impacts (SDG 13); and ensuring inclusive and equitable quality education and promote lifelong learning opportunities for all (SDG 4).

We break from the UN SDGs' approach of 'developing' and 'modernizing' our way out of the climate crisis while asking those living in the Global South (Global Majority) and other locations of disproportionate precarity to become more 'resilient.' It is within this context that marginalized and racialized communities and more-than-human beings have borne witness to a climate of colonial change over the last 500 years, resulting in massive shifts in human relations, ecologies, and earth systems (Whyte 2018; Scherrer et al., 2024). For example, colonialism's adaptive and assimilative methods showed little interest in developing existing education and knowledge systems and instead reshaped them to reflect the colonizers' culture and language (jules et al., 2021). Such modes of colonial assimilation can arguably be seen influencing 'Western technological fixes,' reproducing and escalating the relational inequities and forms of accumulation through dispossession. As in the case of lithium mining and the extraction of other rare earth

metals, massive amounts of land (and water) are destroyed, fuelling regional (and global) conflicts. Such approaches to wicked problems overlook the rest of the world, which resides on the 'other side' of global capital flows. Continuing to deny such relational shifts perpetuates the problems central to the broader climate crisis.

Identifying the limits of the existing system of climate solutionism, it is essential to rethink the climate and nature emergency (CNE) in education. Rousell and Cutter-Mackenzie-Knowles (2020) draw attention to how it is "widely acknowledged that innovative and effective forms of climate change education are needed for children and young people worldwide who will be forced to grapple with the uncertain effects of climate change brought forth by previous generations" (p. 192). Our current educational approaches, which are grounded in Western scientific innovations and policy change to anthropogenic challenges, are ahistorical and erase any sense of responsibility. These approaches do not adequately address the underlying issues of the problems at hand. Instead, they focus on providing students with scientific information and knowledge awareness, devoid of context (Scherrer, 2023).

In this historical moment, centered on the transition to a "greener future," markets continue to push communities in the Global South, including their children, into pits and tunnels, destroying landscapes and sources of clean water. At the same time, American corporations and nation-states are reported to have become legally immune to child labor as well as health and safety laws in the areas where these minerals are being extracted (Amnesty International, September 11, 2023). Meanwhile, forms of climate justice are being integrated into the fold of sustainable development. The events of the 2024 Conference of the Parties (COP) in Baku, within the oil-rich state of Azerbaijan, unfolded against a backdrop of corporate energy logos and active oil rigs. This should serve as a warning about the dangers of pursuing universalized development goals that suggest a need for incorporating self-interest. Furthermore, in the last three global climate summits, spaces for community advocates, Indigenous groups, and social organizations—the seeds of a better future—were replaced by corporate groups seeking to promote their interests within the same framework, albeit toward a more greenwashed future (Scherrer and jules, 2023). In light of this, scholars and practitioners in the fields should consider how the erasure of the roles of those most impacted and engaged highlights the work of CIE: How can the seeds of Otherwise worlds, generated in place and community, be nourished and storied into being, even (and especially) when they do not "belong" in the world as it exists?

We introduce a method of critical engagement with the topic through specific counter-reading practices inspired by Said (1994). The following section examines the concept of coloniality concerning climate change and education, highlighting the shifting spatial and temporal boundaries in the process. The paper then addresses decolonial ecologies and how such approaches might disrupt the field's status quo. The paper engages more specifically with deciphering practices (Wynter, 1992), or methods of

thinking critically about specific educational practices and policies. This sets the stage for discussing just educational futures and reimagining climate change education within decolonial educational ecologies.

Revealing Counterpoints (and Otherwise Worlds): A Contrapuntal Analytical Approach

This paper employs a 'contrapuntal reading' (Said, 1994) of climate change in education. In *Culture and Imperialism*, Said (1994) conceptualized contrapuntal reading as a method of analyzing texts by considering the intertwined narratives from both dominant and marginalized perspectives, thereby uncovering the complex and interrelated relationships between them. Inspired by the musical concept of 'counterpoint,' which refers to the simultaneous interaction of independent melodies, Said (1994) applied this idea in literary and cultural analysis to explore the connection between colonialism and cultural formations. Such practice offers opportunities for deciphering existing grammars while building different modes of relational and justice-centered knowledge production that refuse the individuated logics of racialized extraction and dispossession (Rashid, 2024). Contrapuntal readings encourage readers to challenge established narratives.

In CIE, contrapuntal readings serve as key reference points for analyzing how knowledge is produced, circulated, and legitimized across various national educational contexts. This approach is especially significant when examining the effects of colonial legacies (i.e., coloniality), global power dynamics, and epistemic hierarchies in education. For instance, when analyzing a colonial text, it is crucial to consider not only the colonizer's perspective but also the voices and viewpoints of those who were colonized or silenced within the text. This method uncovers hidden power dynamics and neglected histories of the oppressed context. In conducting a contrapuntal reading of the climate education discourse, texts, and ecologies, we focus on which voices are amplified and which are marginalized.

In thinking about the processes of finding counterpoints as part of a practice of reinventing approaches to education, we are reminded how the human species is shaped both biologically, through genetic and environmental predeterminants like other living organisms, and a form of hybridity, as a storied being (Wynter, 2003; Wynter & McKittrick, 2015). This formulation gestures toward the idea that, unlike other species, the rhythms/patterns/narratives that are told and practiced can determine the nature of our being. The narratives (that is, independent yet intertwined counterpoints) selected/deselected over time produce new stories or truths (Wynter, 2003). The power of which narratives are selected reinforces different neurological responses or connections that create (and reshape) our renewed understanding of both the historical origins and futures of, in this case, the meaning of climate change in education.

A Grammar of Climate Coloniality

> Students are not only raising questions about the relevance of their education, but also bringing attention to the fact that education itself is entangled with and dependent on the same unsustainable political-economic system that has led to climate change in the first place. (Stein, 2024, p. 1).

The epigraph above speaks to the contradictions, growing consensus, and sobering assessments climate education faces because of 'climate coloniality' and the fact that climate change has ontological, onto-epistemological, and axiological dimensions in that "it alerts us to questions of being (who we are and how we relate to the natural world), of knowledge (whose version of events should we trust) and value (what might be a fair distribution of the burdens of change)" (McCowan, 2023, p. 935). Colonialism, "often defined as the conquest and subjugation of other people's land and goods" (jules et al., 2021, p. 49), had two primary objectives in education that were about gaining "mental control" (wa Thiong'o, 1986) through: the destruction of culture and consciousness, and (training an elite class of subordinate servants (jules et al., 2021). Anuar and colleagues (2020) remind us that in CIE, a growing body of scholarship on "post-colonialism highlights and problematizes modern colonialism as a vehicle of capitalist expansion through the exploitation of the colonies, coupled with an ideological rhetoric of modernity and progress" (p. 110, as cited by Bhambra, 2014; Sinha &Varma, 2017). It is generally understood that in terms of relation in CIE, the field primarily relies on ideals, targets, standards, and goals emanating from concepts of growth grounded within an invented place (or concept) that is often referred to as the West (Takayama et al., 2017). Foundations across the field are predicated on the logic of infinite growth and the disproven assumption that Western education develops citizens who will solve today's problems (Scherrer, 2023). This section continues this conversation and reviews how this colonial nature has extended to complicity in modernization, capitalism, and slavery, which are not escaping climate change education efforts.

Building on the scholarship of coloniality emerging from decolonial thinkers like Aníbal Quijano (2000; 2007) and Walter Mignolo (2011; 2017), which describes the ongoing power structures, inequalities, and epistemologies that arose from European colonialism and continue to shape the modern world, climate coloniality refers to how these historical and persistent colonial frameworks influence the distribution of climate impacts, adaptation strategies, and environmental governance. Coloniality is premised on racial domination and hierarchical power structures that were established during colonialism and continue in post-colonial contexts, where the colonial matrix of power persists (Mignolo & Walsh, 2018; Quijano, 2007). Whether called 'climate coloniality,' 'green colonialism,' 'carbon colonialism,' or 'fossil capitalism,' it arose when Eurocentric dominance, neocolonial practices, racial capitalism, unequal consumption, and military power combined to shape the climate effects encountered by racially marginalized groups, rendering them particularly vulnerable and expendable (Sultana, 2022). For us, climate coloniality is demonstrated by the unequal ways in which former colonies in the

Global South bear the heaviest impacts of climate change, such as rising sea levels, extreme weather, and biodiversity loss, despite contributing the least to greenhouse gas emissions (Khan et al., 2022). Climate solutions, such as lithium mining for batteries and land grabs for carbon offset initiatives, continue to perpetuate colonial resource extraction patterns. For example, when considering how new battery technologies are central to technological solutions to the current crisis, how does solving the world's wicked problems downplay the ramifications of the shifts from fossil fuel extraction to mineral extraction?

Others have argued that the proposed solutions to climate change only perpetuate colonialism since it often involves land grabs, extraction, displacement, and dispossession (Ajap, 2024; Ferdinand, 2021; Sultana, 2022). This is because:

> Climate colonialism forces a re-embodiment and relocation of how, why, and who is at fault/responsible. The climate is failing to change. It is being colonized and forced to alter, modify, and—as catastrophes indicate—it is rebelling and resisting the assault upon it. (Martinez, 2014, p. 79).

Climate coloniality is becoming ubiquitous, and post-colonial countries continue to be pushed aside (and out altogether) in international negotiations and the decisions leading to narratives on climate change (Sultana, 2022). Climate coloniality serves as a way to highlight what has been called the ' anthropo-obscene' (Ernstson & Swyngedouw, 2019) by unearthing the technocratic discourse that depoliticizes and coexists with excessive capitalist accumulation.

The challenge of climate change cannot be meaningfully addressed without addressing historical, underlying systemic issues that caused this in the first place. Sultana (2022) highlights that meetings such as COP and other climate negotiations are merely 'global theaters' of discursive proforma that are premised upon "depoliticized techno-economist utopias that never deliver" and are grounded on the "performance of diversion, delay, co-optation, and performativity without substance is repeated almost annually" (p. 2). The sense of coloniality that still permeates the discussions around climate change creates embodied colonial wounds that are steeped in both material and epistemological colonial and imperial violence and have subsequently been engraved in the bodies and minds of those who are most affected by anthropogenic changes in the Global South. Educating about climate change should begin by accounting for the spatialization of colonialism's historical extension into the present. This is because anthropogenic changes bring to the forefront not only the efficacy of historical colonialism but also the ongoing effects of coloniality, which have come to govern the structures of life and are indoctrinated through the processes of capital accumulation, international development, and coloniality.

When discussing climate coloniality, the colonial logic of extractivism has persisted through neocolonial and development interventions since World War II and through the

Bretton Woods Institutions. The unequal ecological exchange between the Global South and the Global North, the ongoing practices of extractive capitalism, and the imperial frameworks of global trade and policymaking all contribute to the persistence of climate coloniality's multidimensional nature. The legacies of colonial violence and the use of human capital to drive overdevelopment have created environmental harm in the name of modernity. Education and its linkage to economic theories, such as the rates of return (Psacharopoulos, 1972), have been at the forefront of engendering capitalist extraction. In the post-colonial period, countries in the Global South were told that development was linear (citing Rostow [1960]'s five stages of development) and that Western modernization could be achieved by moving from agrarian to manufacturing to industrial to scientific modernity. What was not made clear was that Western modernization would come at a price to be paid later in the form of climate-fueled natural hazards and ecological degradation. The spillover effects and hidden costs of modernization, pollution, toxic waste, disasters, desertification, deforestation, and land erosion were not revealed to Southern countries, and the fact that they would suffer more from these knock-on effects than those who caused them. Modernization has fallen short of its promises, producing an ideological concoction of global capitalism, economic growth ideologies, and climate disasters that are dependent on degradation, displacement, denomination, dispossession, and extractivism that benefit a few and make vulnerable and disposable millions. Development logics focusing on shareholder profit maximization and hierarchies of power relations only highlight the continuity of colonial dispossession.

The rise of what has been called climate apartheid, where the affluent shield themselves from the harshest impacts of climate change, leaving the global poor to endure the consequences, exists at the intersection of race, gender, and class, impacted by ecological harms and toxic environments. This demonstrates how the West is unwilling to take responsibility for its historical actions and that epistemic injustice abounds (Tuana, 2019; Williams, 2021). Climate apartheid results from modernist extractivist capitalism, which is based on the rates of return and unfettered by climate coloniality. If the consequences of these inequalities go unrecognized, they influence how we approach climate education. Instead of centering people as part of the solution, climate coloniality thrives on the racialization of the Other and has disproportional consequences for the poor, marginalized, and most vulnerable. In the rise of eco-apartheid between the Global South and the Global North, epistemic violence persists as the status quo due to the Western dominance in climate discourse and, in turn, how the topic is constructed in education. This has consequences for national educational systems because we have come to normalize Eurocentric knowledge production through "methodological whiteness" (Bhambra, 2017) and have attuned the colonial white gaze upon the non-white Other in the Global South and expounded white saviorism around climate solutions (Sultana, 2022). However, all is not lost. Education can offer us a path toward "ontological disobedience" (Burman, 2017) by disrupting the epistemologically and ontologically deficient (Mignolo, 2017) that comes with Othering. Such displacement

allows us to reconceptualize what it means to be human (Wynter, 2003; Wynter & McKittrick, 2015). Addressing epistemic violence necessitates transcending colonial power structures by embracing epistemological and ontological changes that promote what have been called forms of pluriversality instead (Escobar, 2020), and this is where decoloniality comes into play.

Transcending the Limits of Coloniality: Decolonial Educational Ecologies

In advancing an ecological approach to climate coloniality in education through the conceptualization of decolonial educational ecologies, we build on Malcolm Ferdinand's concept of decolonial ecology. Decolonial ecological frameworks suggest that a break from hegemonic spatial, temporal, and epistemological frames can occur through subversive connections and reconnections within the contextualities of landscapes that offer material and epistemological shifts that extend beyond Western anthropocentric frames and social/environmental fractures, including the use of the Anthropocene and what it obscures. Following existing critiques from Black and Indigenous perspectives (Davis & Todd, 2017; J. Davis et al., 2019; Ferdinand, 2021; Nxumalo, 2021; Whyte, 2018), we suggest that using the Anthropocene as a conceptual tool for addressing climate change in education is a critique that comes up short, erasing and obscuring Black and Indigenous relations, perspectives, and modes of living that are not in line with hegemonic colonial order. Ferdinand (2021) interrogates Anthropocene approaches to thinking about climate and singular ecological conceptualizations by asking:

> Could it really be that the global enterprise, which from the fifteenth to the twentieth century was predicated upon the exploitation of humans and non-humans, including the decimation of millions of Indigenous people in the Americas, Africa, Asia, and Oceania, the forced transportation of millions of Africans, and centuries-long slavery, has no material or philosophical relationship with ecological thinking today? Are the ecological crisis and the Anthropocene new expressions of the 'White man's burden' to have 'Humanity' from itself?' (p. 10)

Ferdinand's (2021) double fracture underscores the rift between environmentalism, rooted in white utopias, and social and colonial struggles. The epistemological conditions of modernity silence those excluded from the world. Both land and marginalized human experiences are redefined through colonial logic. Spatial relations in the modern world are perpetuated and regenerated through what Ferdinand (2021) describes as forms of colonial inhabitation that are 'off-earth' concerning the designation of Indigenous land as terra nullius, a place devoid of history. In colonial ecologies, place is reimagined through the distorted logic inherent in the (re)ordering of the plantation worldview (Scherrer, 2023). The colonial nature of educational structures and their consequences provide lessons similar to how books and texts guide approaches to decolonial education, offering prompts or reminders during the process of rereading and

reconstructing worldviews while also reminding ourselves that other ways of being–other worlds–are already present and have always existed.

The double fracture reveals the epistemological conditions of modernity that silence those excluded from the world. Both land and the marginalized 'less civilized' human experience are redefined through colonial logic. By inhabiting the earth through colonial ecologies, place is reimagined through the twisted logic inherent in the plantation worldview, in which the nature of educational structures mirrors economic frameworks. The aftermaths of such derangements provide lessons similar to how books and texts teach approaches to decolonial education, offering prompts or reminders during the process of rereading and reconstructing worldviews (McKittrick, 2022). A fundamental aspect of a decolonial educational ecology in climate education involves incorporating decolonial, anti-colonial, feminist, anti-racist, and anti-capitalist critiques and movements into climate education discussions and practices. This integration aims to address ongoing oppression and marginalization, in addition to the plurality of historical and contemporary movements (many emerging from the Global South) that can serve as guides and the foundation for lessons.

Education, particularly in the realms of climate education and sustainable development, remains intertwined with and heavily reliant on an unsustainable political-economic system that drives Western human-induced destruction. Today, climate education is framed as a challenge that can be addressed through the swift adoption of technological innovations, leveraging individuals with new forms of scientific expertise and tech-based knowledge to facilitate our return to a "business as usual, but greener" model (Baskin, 2019). Present approaches to climate education are rooted in a deficit language that represents the climate crisis as something recent, solvable through access to and application of Western knowledge, while coexisting with existing consumption patterns. These mainstream methods highlight the historical harm that has been inflicted and continues to occur, pointing out that these complex injustices and ecological violence tend to disproportionately affect communities that have played the smallest role in the current crisis. When discussing the crisis, existing approaches to climate education do not regard the current anthropogenic situation as a 'crisis' in the traditional sense, but rather as the cost of doing business; like any effective business model, climate challenges are seen as solvable through "renewable energy technologies [which] presume unfettered access to metal, minerals, concrete, land, and water, which can lead to political conflict, environmental degradation, and the intensification of land and water grabs" (Stein et al., 2023, p. 990). Such strategies are commonly perceived as beneficial and are not seen as contributing to coloniality, even though they further marginalize vulnerable groups, displace people, and extract finite, nonrenewable resources.

Grounding Decolonial Education Ecology in Critical Inquiry

To remedy these deficiencies, decolonial educational ecology helps us rethink climate solutionism, which must work in and beyond Western onto-epistemological knowledge

frameworks. Identifying a concealed contradiction in the current approaches to climate education, the primary focus on 'green' solutions remains. Referring back to the battery example mentioned earlier, students often overlook the link between extraction, dispossession, and exploitation, which is essential to understanding the rationale behind renewable energy. A decolonial educational ecology is motivated by a profound understanding of the geopolitics of knowledge production, including who gets invited to the conversation, who is cited, which epistemologies are considered, whose ontologies are recognized, as well as who is invited to speak, who is listened to, and who participates in setting agendas. It asks students to recognize and concede that the constitutive of modernity (e.g., colonial/colonizing ecologies), which emerged through European colonization and is grounded in white/male/Christian supremacy (Grosfoguel 2007; Mignolo 2011; Quijano 2000), has been engendered through colonial actions (genocide, ecocide, epistemicide, dispossession, subjugation, extraction, exploitation). Since modernity/coloniality go hand-in-hand, a decolonial educational ecology does not promote or reproduce white/settler saviorism and advances white/settler colonial futures (Stein et al., 2023). For example, what right do Western corporations and leaders have in telling the Global South how to develop their way out of climate problems when, for example, the entire continent of Africa, nearly 20% of the global population, only contributes between 2 to 4% of global greenhouse gases (World Meteorological Organization, 2023)?

Instead, decolonial educational ecologies are based on critical inquiries that encourage students to ask questions, engage with contextualized phenomena, dismantle histories and hierarchies, and reconstruct the fixed, growth-based boundaries accepted as part of Western scientific modernity. Ecological violence is intergenerational, and the modus operandi of unchecked capitalist accumulation—whether 'green' or not—is driven by humans' demand for cheap land, labor, and resources. A decolonial educational ecology urges us to consider the hidden ecological costs of modernity. Attempts to mitigate anthropogenic changes are most often addressed through superficial solutions and quick fixes. Indigenous communities have been experiencing the consequences of climate change for some time. As Whyte (2018) succinctly stated, "the harms many non-Indigenous persons dread most of the climate crisis are ones that Indigenous peoples have endured already due to different forms of colonialism: ecosystem collapse, species loss, economic crash, drastic relocation, and cultural disintegration" (pp. 296-297). Decolonial educational ecologies highlight the importance of identifying human-induced challenges, questioning the normalization of universal truths, addressing technological impositions, and re-centering Eurocentric dualisms, hegemonies, and modernity—elements inherent in colonial ecologies. This approach aims to address these issues through distributive justice, reparations, and restitution (Táiwò, 2022).

A decolonial educational ecology is interconnected with the initiative of decolonizing climate education. This is urgently necessary due to the disconnect between what

students are prepared for and the specific situated realities they face now and in the future (Scherrer, 2022). Patel (2015) urges scholars to conceive of "oneself as part of colonial history and present is hard, that a reclamation and refusal of research is unsettling, and learning about research is cultural practice" (p. 85). Such cultural practices, including finding oneself in history, are inherently decolonial, challenging hegemonic notions that position scientific and historical knowledge as objective, neutral, and detached from personal or cultural influences (Patel, 2015). The concept and practice of decolonizing can be anti-colonial as long as the approach addresses the root cause, which involves confronting the ingrained colonial nature of systemic change. Climate change education necessitates specific liberating and renewing decolonial approaches that acknowledge the colonial nature of intertwined social and ecological issues, dismantle them, and move beyond surface-level problems by avoiding what we view as new policies through a singular critical lens.

Rejecting Climate Solutionism

With the rise of social media highlighting ecological destruction from climate disasters in previously protected areas, such as the extreme fires in Los Angeles in 2025 and severe weather in the southern United States, students are advocating for stronger "justice-oriented institutional commitments to socio-ecological change" (Stein et al., 2023, p. 988). They urge us to avoid 'climate solutionism,' which tends to emphasize solutions that focus solely on scientific and technological fixes. Moving away from solutions-oriented climate education requires asking educators different questions that target the fundamental aspects of Western modernity. Growing movements of student activists (e.g., Sunrise Movement) demand not seeing climate change merely as a 'problem' to solve but as something that must be tackled and eradicated, addressing the embedded nature of technological and late-stage capitalist systems that uphold and perpetuate it. We propose that decolonial educational ecologies, which highlight coloniality as the foundational aspect of modernity, offer an alternative approach. To be clear, we are not suggesting decoloniality as a cure-all to resolve the solutions-oriented culture surrounding climate education. Decolonizing involves a process of conceptual refinement. Some have adopted the term 'anti-colonial,' similar to decolonizing in its goal of dismantling colonial structures and embracing Black and Indigenous ways of knowing, rejecting colonialism by practicing differently, beyond its spatial and temporal frameworks. For instance, it must tackle how the land is contaminated by colonial concepts (i.e., patriarchy, imperialism). Approaches aimed at such deconstruction should incorporate Indigenous perspectives on land by dismantling these colonial concepts. They argue that 'quick fixes' fail to address the root causes, resulting in insufficient outcomes. This, in turn, suggests that the agents delivering these solutions operate with limited perspectives.

Ajap (2024) reviews how human-centeredness, epistemic inequity, globalization, neoliberalism, pedagogical incompatibility, and social inequality are inhibitors to

realigning justice-based environmental efforts toward sustainable ecocentric pedagogy and practices in higher education. Consequently, Stein et al. (2023) remind us that:

> Any climate education is likely to reproduce colonial patterns if it relies on the same intellectual, affective, and relational infrastructures of our current (modern/colonial) system, and if we remain (consciously and unconsciously) invested in the promises this system has offered to those it was designed to benefit. (p. 992).

However, this is easier said than done, as faculty have reported significant challenges (educational backgrounds, individual and psychological barriers to change, systemic and institutional barriers to change, and the need for effective strategies, resources, and actions) in attempting to challenge colonial logics within a Western university context (Bills & Klinsky, 2023).

Several scholars have called for critical climate education (CCE) (Stein, 2024; Svarstad, 2021; Svarstad et al., 2023), as an alternative to mainstream climate education that recognizes the historical wrong of colonialism and the current ecological crisis and the systematic nature of European colonial violence and chattel slaves that emerged in the fifteenth century stem from the same point of origin (Whyte, 2020; Wynter & McKittrick, 2015). We argue that this is similar to the decolonial educational ecology because CCE and the decolonial educational ecology that is put forward above begin from the premise that (i) they recognize that there were other forms of colonialism but single out European colonialism because of its shared brutality, scale, and lasting effects (racialization, extraction, domination, exploitation, and dispossession) that are embedded within capitalism accumulation; (ii) the current political-economic system is organized around *anthropocentrism*, which is the belief that man and nature are separate; and (iii) the reinforcement of scientific racism that espouses the idea that racialized peoples are subservient to "white" people. Although the Intergovernmental Panel on Climate Change (IPCC) report (2022) acknowledged colonialism as a factor influencing climate change and a recent report from the UN Special Rapporteur suggests that "there can be no meaningful mitigation or resolution of the global ecological crisis without specific action to address systemic racism, in particular, the historic and contemporary racial legacies of colonialism and slavery" (Achiume, 2022, p. 2), skepticism around the ecological foundations of climate change abound.

Conclusion: Deciphering and Practicing Decolonial Epistemic Futures

The issue with climate education is that it reinforces "the normalization and naturalization of colonial hierarchies and capitalist imperatives have led us to neglect our responsibilities to each other and to 'nature'/the Earth as a living entity (a metabolic system) that we are also part of" (Ferdinand, 2021; Stein, 2024, p. 4). Decolonial educational ecologies grounded in decolonial and Indigenous practices, cosmologies, and futurities challenge the consideration of alternatives to the current

political-economic static binary, embrace more-than-human elements, and avoid further exacerbating current climate *in*justices (e.g., under the guise of developing future 'green' or 'resilient' solutions). Decolonial educational ecologies do not aim for universalism but is based upon context and the specificities of local adaptation (e.g., see indigenization in Ferdinand, 2021) because they must recognize that while modernity claims to speak in universal truths, it treats economic growth and development as linear and assigns no sense of agency to the current climate crisis. Decolonial educational ecologies prioritize human well-being, while at the same time recognizing the relational obligations with more-than-human kin (living and nonliving). Decolonial educational ecologies should be aware of not reproducing colonial dynamics and coloniality, and failing to identify the specificities obscured by labeling the situation as the Anthropocene. Disentangling decolonizing approaches from the historical roots of colonization is critical, as superficial "dismantling" sometimes fails to unlearn the deeply rooted, perpetuated colonial natures in decision-making and the related patterns and rhythms that govern educational landscapes (Mbengue, Diame, & Scherrer, 2024). The concern is that representations of Black and/or Indigenous people provide forms of "verifiable truth" through negative portrayals of individuals and places.

Returning explicitly to our practice of contrapuntal reading (Said, 1994), in this article, we offered a series of 'counterpoints' interactions that largely remain illegible within dominant discourse. The 'independent melodies' within decolonial educational ecologies reveal the connections between modes of colonialism and related cultural formations. In offering something different from existing grammars, while building alternative modes of knowledge production grounded in place, our contrapuntal reading practice challenges you, the reader, to establish narratives and new stories beyond the 'comforting' ways of knowing and being within universal Western patterns of modernity. New practices and their logics can be uncovered and renewed through rereading and deciphering solutions to take into account multiple forms of social reality. Such practices offer opportunities to reconsider different ways of seeing and feeling the world, rupturing existing patterns and rhythms of the dominant social order, ways that can initiate new forms of psychological response reinforced by decolonial ecologies and their ways of knowing and being. McKittrick (2022) suggests that practices of deciphering dominant narrative (e.g. climate policy and education in this case) can be done in the work of exploring and uncovering the ways Black and Indigenous (and Black-Indigenous) communities have continuously innovated and creatively practiced new social realities, navigating not only extractive systems of racism but living Otherwise, and by envisioning alternative futures. Everyday forms of lived Black and Indigenous praxis expose the limits of white supremacy and Western colonization of land and people that continue to be reinscribed within hegemonic traditions of knowledge production (Scherrer, 2023). In this way, creative forms of anti-colonial life involve living differently, reinventing and reimagining that world through different stories (Alagraa, 2021).

Turning to Carter's recent book review of *Maroon Choreography* in Comparative Education Review—a book that speculates on the long (im)material, ecological, and aesthetic afterlives of black fugitivity and the practices that might lead us out of social-ecological collapse— "reminded (as if one could forget) that our compulsory education systems are colonially choreographed" (p. 373). The wayward figure of the Black/Indigenous maroon resisting colonial domination gestures toward historical and future methods for reorienting and repairing the earth, both internally and practically, entangled within the complexities of shifting diasporic and ecological relationalities (Ferdinand, 2021). This leads us to ask ourselves: What lessons am I telling and how am I telling them? It is in the process of exploring deeper modes of social and ecological relations that the possibility of decolonial thought (and practice) emerges, where spaces are created for imagining otherwise, rather than the other way around. Such a decolonial orientation counters paradigms that assume thinking comes before being. In this counterpoint, a new rhythm emerges; the Western episteme should be reexamined, involving a remapping of genealogies. It is within this possibility, towards a different set of lessons, stories, and ecological relations, that other worlds emerge.

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Climate Policies and Financing for Conflict and Displacement-Affected Contexts: Closing the Capacity and Education Gaps

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New data streams highlight the low levels of access to climate finance by the most climate-vulnerable countries, which struggle with conflict and displacement and call for more effective financing mechanisms. While such measures are urgent, their effectiveness and impact depend on investments in capacity development and education. In exploring recent international policy trends in climate, conflict, and displacement, this article argues for greater attention to endogenous capacities and implementation of science-informed approaches. It highlights the key role academia and the education sector can play in addressing these gaps. In contexts where conflict and displacement are ongoing, and climate and insecurity jeopardize sustainability, this paper argues that strengthened capacities can represent a critical adaptation measure and a no-regrets investment opportunity.

Keywords: Climate change, conflict, displacement, migration, capacity development, education.

Introduction

The tenth anniversary year of the Paris Agreement takes place in 2025, against the backdrop of the highest levels of conflict[1] and displacement[2] since the inception of the UN and record levels of global warming. With third-generation Nationally Determined Contributions under the Paris Agreement due in 2025, a new opportunity arises to revisit progress on climate change. Going beyond the established and prosaic understanding of poverty and development interlinkages, to the intersections of climate with conflict and insecurity, increasingly recognized as "Climate, Peace and Security" on the one hand, and with migration and displacement on the other. Recent developments include a marked recognition of conflict and displacement as relevant to climate change. The 27th Conference of the Parties (COP27) of the UN Framework Convention on

[1] The Institute for Economics and Peace's (IEP) 2024 Global Peace Index reports that there were 56 ongoing conflicts, the highest number of concurrent conflicts since World War II, with the second highest annual level of conflict-related deaths in the last 30 years.

[2] UNHCR reported that displacement reached record levels in 2024, at 120 million in May 2024, with 12 years of consecutive increases in displacement witnessed.

Climate Change (UNFCCC) gave attention to the interactions between climate, conflict, and displacement.

New streams of data highlight the low levels of access to climate finance by the most climate-vulnerable countries, which struggle with conflict and displacement and call for more effective financing mechanisms (UNDP, 2021; Overseas Development Institute [ODI], 2021; Wong, 2023; World Bank Group, 2024). While such changes are urgent, effectiveness and impact will depend on investments in capacity development in education. In exploring recent trends in climate, conflict, and displacement, this article argues for greater attention to strengthening endogenous capacities, the academia and the education sector can play a key role (Juckett et al., 2022) in addressing these gaps. In contexts where conflict and displacement are ongoing, and climate and insecurity jeopardize sustainability, this paper argues that strengthened capacities can represent a critical adaptation measure (Cid & Lerner, 2023) and a 'no regrets' (Intergovernmental Panel on Climate Change [IPCC], 1996) investment opportunity in education.

Literature Review

Conceptualizing Capacity Development for Climate, Conflict, and Displacement

The literature on capacity and capacity development in the case of climate, conflict, and displacement is sparse. Definitions vary and have evolved, informed as much by the epistemology of education and research as by development practice. Tangential references can be drawn from the climate field. The 1992 UN Conference on Environment and Development made the case for capacity building, which strengthens "endogenous capacities in developing countries" (UN, 1992). The UNDP (2002) *Capacity for Development* explored the nature of capacity and capacity development, defining capacity as "the ability to perform functions, solve problems and set and achieve objectives" (p. 8).

Noting the ambiguity in defining capacity development in international climate change negotiations, Nautiyal and Klinsky (2022) stress that a departure is needed from a narrow short-term project-based focus on techno-managerial aspects to approaches that are transdisciplinary, holistic, and engage diverse groups of stakeholders (see Susskind & Kim, 2021). In countries affected by ongoing conflict and insecurity, Brown and colleagues (2013) found that tackling climate change is understood as a priority. Institutions, networks, and inter-institutional linkages focused on learning and knowledge promote adaptive capacity and peacebuilding. Higher education establishments are recognized as some of society's most enduring institutions (Dodgson & Gann, 2018), including in conflict-affected countries (Bukaie et al., 2025; Milton, 2020) and as establishments that build the capacity of climate change professionals in developing countries (Huq, 2016). Displacement-related brain drain is an issue

impacting capacities to respond to climate change (Buhaug & von Uexkell, 2021). Greater efforts are needed to overcome the systematic challenges of multi-stakeholder approaches to capacity development (Miquelajauregui, 2021). Focusing on North-South collaboration and dynamics in academia, Ishengoma (2016) emphasizes the role of equitable partnerships in advancing institutional and personal capacity building.

Reflecting on the impetus for capacity development initiatives, Sokona (2021) advocates a perspective of capacity development rooted in local context, partnerships, and networks of research. He stresses self-determination in capacity development, as "the ability to set and pursue your own agenda" (p. 2). Juckett and colleagues (2022) discuss the need for "implementation practice capacity building interventions" to fill a vital gap between research and practice. They note a disconnect in the pace at which implementation science evolves, a gap where capacity development initiatives tend to target the research community, instead of practitioners, and that academic institutions and the education sector play an important role in connecting research and practice.

Drawing from the perspectives of capacity, capacity development, the role of research and academia, and the education sector in addressing climate, conflict, and displacement, this article analyzes the latest developments. It makes use of Lusthaus et and others' (1999) conceptualization of capacity development as four approaches. These are: **organizational**, which focuses on individual entities; **institutional**, referring to the norms and values that shape them; **systemic**, which concerns the inclusivity of actors at all levels; and **participatory**, underpinned by empowerment and ownership. In assessing progress, it identifies institutional capacity as a key aspect of adaptive capacity (Cid & Lerner, 2023) in the context of addressing climate, conflict, and displacement.

Climate, Conflict and Displacement: The Literature and the Limitations of Capacity

Hobbes' (1668) *Leviathan* explains inevitable conflict arising from resource scarcity as a 'natural' state and that to avoid it, and civil war, a strong social contract and state are necessary. This sentiment is evident in Malthus's (1798) seminal work, *Essay on the Principle of Population,* which connects population growth, resource scarcity, and resulting hunger and famine to eventual war and state failure. The intellectually dystopian debate, linking resource scarcity to societal collapse, is continued by Neo-Malthusians, including in the works of Homer-Dixon (1994), Gleditsch (1998), Myers & Kent (1995), and Mathews (1989). Much research has been devoted to discerning the relationship between climate change and the causes of violent conflict and/or insecurity, in an attempt to establish a causal relationship (Burke et al., 2015; Hsiang et al., 2011; Mach et al., 2019; Miguel et al., 2004). The mainstream consensus in the literature, however, shows, contrarily, no direct causal relationship between climate change and violent conflict. Climate change is recognized as an exacerbating factor, a 'threat multiplier,' a term first coined by the Center for Naval Analysis in 2007. More

recent thinking has drawn on 'risk multiplier' effects, systemic risk, and/or causal pathways, which can give rise to the prolongation or exacerbation of conflict dynamics.

Country case studies have aimed to examine interactions between climate and drivers of conflict and insecurity in such climate and security hotspots, as Somalia, Afghanistan, Lake Chad, the Democratic Republic of Congo, and Yemen. Their selection has involved overlaying indices that correlate the high levels of armed conflict and climate hazards. Some scholars argue that such methods risk overstating the case and are criticized for the resulting 'streetlight effect,' i.e., where data is sought where it is most easily found (Hendrix, 2017). Alternative avenues of investigation, under the theoretical umbrella of environmental peacebuilding (Conca, 2024; Conca & Dabelko, 2002; Ide et al., 2021), aim to uncover cooperation around the environment and climate as the basis for building and sustaining peace. From this, an understanding has emerged among scholars and policymakers of the impact of climate on peace and security, the application of peacebuilding approaches to climate and the environment (Abrahams, 2021), and the potential unexpected negative social or environmental etc. impacts or backdraft effects of climate policies (Dabelko et al., 2013).

The effects of climate change on migration go beyond established patterns (Glantz, 1991). Scholars stress migration is the combination of multiple factors, of which demographics and political economy are the 'most salient factors,' and the environment is the 'proximate cause' (Suhrke, 1992). Migration is, at times, rightly considered to be a form of adaptation (McLeman & Smit, 2006; Gemenne & Blocher, 2017), where mobility enables livelihood diversification (Vinke et al., 2020). However, with the resulting increased food insecurity, welfare losses, and labor shortages that accompany migration in some cases, arguments persist as to whether migration is actually "maladaptation" and an effective "climate-induced poverty trap" (Jacobson et al., 2018). An abundance of outcomes can thus be evidenced in a myriad of different combinations of place of origin, destination, and host communities. Responses to climate impacts are noted as having the potential to drive or exacerbate displacement (Kramarz, Park & Johnson, 2021).

In terms of the role of capacity and capacity development, there is little in-depth examination. References are limited to adaptive capacity (Brown et al., 2013; Chapagain et al., 2025; Gupta et al., 2010), particularly at a local level (Susskind & Kim, 2021), as well as coping capacities, where Williams and colleagues (2015) explain it as key to breaking the cycle of climate, insecurity, and migration. Black, Bennett, Thomas et al. (2011) describe the environment both as an incentive for mobility and also a limiting factor on capacity, observing that many may migrate to places with high environmental vulnerability. In their endeavor to examine adaptive capacity in a post-conflict context with the Central African Republic as a case study, Brown and colleagues (2013) highlight that the lack of adaptive capacity was effectively mitigated by leveraging networks and connectivity. In turn, this fostered inter-institutional linkages which helped deliver on

the National Adaptation Programme of Action and REDD+ (Brown et al., 2013). While capacity is an enabling factor for adaptive capacity, only its absence is noted.

Policy and Practice: The Challenges and Opportunities

The UN and Climate, Conflict, and Displacement

The Security Council has garnered the attention of scholars and practitioners and has shaped the climate, peace, and security agenda. The Council addressed the implications of climate change for international security in a United Kingdom-led ministerial open debate in 2007, highlighting unprecedented levels of migration due to flooding, disease and famine as a result of climate change, in addition to greater competition for food, water and energy, and potential impacts on large-scale global economic disruption. A subsequent resolution (63/281) by the UN General Assembly in 2009 then called attention to the issue and paved the way for the first UN Secretary-General's report (2009), *Climate Change and its Possible Security Implications* (A/64/350,) which noted the interdependence between human vulnerability and national security. The Peacebuilding Commission, which serves as an advisory body to the UN Security Council and General Assembly, has addressed Climate, Peace and Security in various geographies, including the context of the Lake Chad basin, the Sahel, and the Pacific.

Recent scholarship recognizes the creation of the UN Climate Security Mechanism as an 'institutional home' (Modeer, 2022) for Climate, Peace and Security in the UN system. The UN inter-agency initiative is recognized for providing dedicated capacities in the form of Climate, Peace and Security Advisors to field missions and regional organizations in the Global South (UN, n.d.b). An external evaluation of its work demonstrated that Climate, Peace and Security Advisors have played a key role in supporting the capacities of the UN and its partners, including at regional and sub-regional levels, and in collaborating with academia. In terms of responding to requests for support by affected countries, potential constraints are noted due to the limited pool of expertise (Brusset, 2022).

Various UN entities now offer training on climate, peace, and security: the UN Staff System College and UN Institute for Training and Research (UNITAR). The work of the UN University, including in collaboration with the Secretary-General's Peacebuilding Fund, is well-known in the Climate, Peace and Security field. UNDP's Climate, Peace and Security Experts Academy, launched at the 27th Conference of the Parties (COP27), provides dedicated training to policymakers, climate negotiators, and regional organizational officials from countries and regions affected by conflict and displacement. Wider-reaching impacts can be realized through more systematic collaboration with education and academia.

As an effective counterpoint to a state-driven security rubric, the concept of "human security" was popularized through UNDP's (1994) Human Development Report, entitled *New Dimensions of Human Security,* which offered a people-centred security framework, focusing on the aspiration of freedom from fear, want, and indignity. Over the years, this theory has been modernized iteratively, including in the 2022 recapitulation, *Human Security in the Anthropocene: A New Base for Action,* which revisited this concept following the COVID pandemic, to examine interactions between climate change and environmental factors, with human security. The report addresses political unrest, conflict over critical minerals (including rare earth elements) needed for the production of green technologies, and internal displacement. The IPCC's (2014) Fifth Assessment Report delivered a first-ever dedicated chapter on human security (Adger et al., 2014) and the concepts of violent conflict and fragility, tackled in the Intergovernmental Panel on Climate Change's (IPCC) 2022 Sixth Assessment Report. Importantly, it reaffirms the consensus that climate is not the direct cause of conflict, but solutions targeting climate-sensitive livelihoods and women's empowerment can reduce risks posed to peace. Other findings are salient to the examination for climate risks for conflict and insecurity, including that maladaptation can occur when addressing one set of risks in isolation, and other risks are then inadvertently exacerbated (IPCC, 2022).

Formative Praxis in Addressing Climate and Mobility

Praxis in recent years shows advances in assessing climate impacts on human mobility to varying degrees in different frontiers, including policy fora, international law, and data and analytics. However, innovation toward capacity development and relevant education has not kept pace. Namely, heightened displacement in the context of climate policy leaves gaps that capacity development and education have yet to fill. As the vision of former UN Secretary-General Kofi Annan, and the first major international forum of its kind on the subject, the inaugural Global Forum on Migration and Development took place in 2007 and tackled environmental degradation, climate change, and disasters from the onset (GFMD, 2007). Successive iterations have included leadership from Global South nations (Colombia serves as chair for 2024-2025)and addressed climate mobility. Key milestones are the negotiation of the Global Compact on Migration (A/RES/73/195), adopted by UN Member States in 2018. Though non-legally binding, it broke new ground as the first Member State-negotiated agreement of its kind. Initiatives like the UN Secretary-General's appointment of the High-Level Panel and Office of the Special Adviser on Solutions to Internal Displacement, a role first created in 2022, encumbered by Robert Piper up to year-end 2024, have continued to bring attention to the issues. There are similar calls for a Special Representative of the Secretary-General on Climate, Peace and Security. At large, there are insufficient institutional capacities to address the intersections between climate change, conflict, and climate displacement. Education is essential to develop such capacities.

Despite progress in the policy spheres, the legal status and rights of so-called "climate migrants" or "refugees" are hotly debated vis-à-vis those formally recognized as refugees under the Rome Convention (Draper, 2024). The term "environmental refugee", first coined by the environmental activist and founder of Worldwatch Institute, Lester Brown (1976) and Essam El-Hinnawi (1985), tackled the subject in 1985 for the UN Environment Programme (UNEP), remains contentious. The term is often considered a misnomer as climate displacement is still primarily an internal phenomenon (as recognized in IPCC, 2022, etc.). However, in 2020, the UN High Commissioner for Refugees updated its guidance, making a broader case for the protection of those facing environmental risks. It has been argued that there are instances where the Geneva Convention should apply to those displaced by climate, in the case of drought-related famines which have triggered conflict and displacement (UNHCR, no date).

Much effort has been devoted to quantifying the future impacts of climate change on forced migration, displacement, and relocation (see, for example, The Government Office for Science, 2011). Describing it as one of the "foremost human crises of our times", Myers' (2002) estimate of 200 million climate migrants by 2050 drew much attention and has been one of the most frequently cited figures. This includes the Stern Review (2007) on the *Economics of Climate Change*, duly noted as one of the most comprehensive assessments of climate impacts at the time, which outlines the costs and benefits, and makes the case for climate investments.

Projections of future climate displacement impacts vary greatly. The Institute for Economics & Peace (2020) estimated, in its inaugural iteration of *Ecological Threat Register*, that some 1.2 billion people would be displaced due to ecological disasters by 2050, of which 20% would be "beyond their borders." The World Bank's (2018) *Groundswell - Preparing for Internal Migration* stresses the limitations of in-situ adaptation, in finding that in a pessimistic scenario, more than 200 million people would potentially be internally displaced in six sub-regions by 2050, including Central Asia, Eastern Europe, Latin America, North Africa and South Asia.

Apart from longer-term predictions, annual tracking of displacement has offered striking perspectives. Since 1998, the Internal Displacement Monitoring Centre (IDMC) has compiled data and tracked trends on displacement, by violent conflict and natural disasters. While in 2024, IDMC estimated total cumulative internal displacement at 75.9 million, of which 68.3 million were displaced by conflict and 7.7 million by disasters, climate outpaces conflict as the number one driver of new displacements year after year. This was still the case even with ongoing conflict in the DRC, Gaza, Sudan, and Ukraine.

While it took the IPCC several iterations to address the peace and security implications of climate change (as addressed in the previous section), climate mobility, on the other hand, is acknowledged from the very first iteration. Displacement has featured more

prominently and consistently in the Assessment Reports, but Special Reports, including *Ocean and Cryosphere in a Changing Climate* and *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* (known as SREX). Climate hazards, sudden and slow onset, are recognized by the IPCC (2022) as increasingly exacerbating displacement and involuntary migration, as well as vulnerability to climate change across different global regions. The lack of adaptive capacity underpins this. Other gaps are highlighted, including: modelling for out-migration in coastal regions, projections of movements related to slow-onset events, as well as a need for more nuanced research. It is stressed that greater adaptive capacity can address involuntary migration and immobility and "the degree of choice under which migration decisions are made" (IPCC, 2022). Data and monitoring initiatives are critical to informing policy. Readiness to respond to future increased levels of climate and environmental-related displacement depends on investments in capacities and education.

The State of Ambition in the international climate change negotiations for conflict and displacement-affected populations

The treatment of conflict and migration has varied at the COP on climate change, which may speak to a lack of awareness and capacity gaps. While neither is a negotiated outcome, language on conflict has yet to successfully make the final cut in negotiated texts; the latter, on migration, has received far greater attention across different work streams. It was at COP27, in Sharm el-Sheikh, that the so-called 'Africa COP' paved the way for key breakthroughs in the climate change negotiations, including agreement for the first time on the operationalization of the loss and damage fund. The Egyptian Presidency highlighted the concept of 'sustaining peace' for the first time in the context of the climate change negotiations through its *Climate Responses for Sustaining Peace* initiative, developed by the Cairo International Centre for Conflict Resolution, Peacekeeping and Peacebuilding with the African Union Commission and UNDP. The initiative focused on four pillars: the climate adaptation and peacebuilding nexus, climate-resilient food systems for sustaining peace, durable solutions to the climate-displacement nexus, and accelerating climate finance for sustaining peace (Embassy of Egypt, 2022).

While not a negotiated outcome, *Climate Responses for Sustaining Peace* drew attention from a diverse range of stakeholders. This momentum was continued by the United Arab Emirates, with the COP28 Declaration on Climate, Relief, Recovery and Peace, which garnered the support of more than 90 Member States and institutional partners, including the UN, multilateral development banks, and non-governmental organizations. In COP29, the Baku Call on Climate Action for Peace, Relief and Recovery followed suit from COP28, recognizing themes of relief, recovery, and humanitarian need. It highlighted climate mobility as a cross-cutting issue, across three identified pillars of work: food security, water scarcity, and land degradation (UNFCCC, 2024,

November 6). The increased efforts of UN humanitarian actors at COP are also notable. The Global Refugee Forum addressed climate action and finance in a 2022 call for action for increased financing for displacement-affected contexts, and UNHCR launched its Refugees for Climate Action network at COP29 to give a platform to those suffering from displacement and climate change at international negotiations (UNHCR, 2024).

Only displacement and migration have been referenced in official negotiations. The New Collective Quantified Goal (UNFCCC, 2024, November 24) does not refer to conflict or fragility-affected groups; it does reference "migrants" among other vulnerable groups. The first Global Stocktake (assessing progress toward the Paris Agreement) references displacement, relocation, and migration in the context of loss and damage. Policy and planning are addressed, including planned relocation and the needs of migrants and other vulnerable groups (UNFCCC, 2024). Negotiators had agreed to develop a maximum of 100 indicators for operationalizing the Global Goal on Adaptation (GGA), but thousands of suggestions were received. Negotiating groups had proposed indicators on conflict and displacement. COP30 is expected to determine the final list.

Regarding loss and damage, migrants are referenced in the operationalization of new funding arrangements (UNFCCC, 2023). Climate impacts on forced displacement and relocation are addressed by UNFCCC, in driving and exacerbating climate change vulnerability, and economic and non-economic losses and damages. Challenges are noted about adaptive capacity, institutional, and analytical capacities. Other obstacles include the lack of definition of displacement under the Convention. Displacement is still recognized as "the clearest case" of loss and damage, as evidence of the limits of adaptation, and resulting in physical harm (UNFCCC, 2013). The Warsaw International Mechanism (WIM) for Loss and Damage in 2013 was launched to strengthen knowledge, dialogue, and coordination, including on finance, technology, and capacity building, and gives credence to climate-related mobility and displacement.[3] The Santiago Network for Loss and Damage, established at COP25, under WIM, to "catalyze the technical assistance" of key stakeholders, emphasizes long-term capacities and the participation of diverse stakeholders (UNFCCC, 2022). While capacity is considered at different levels, the need to invest in education and capacity development is overlooked.

Regional Approaches to Climate, Conflict and Displacement

Arguably, the most-affected regions and countries have made the most notable advances in climate change policy. The 2009 African Union Convention for the Protection and Assistance of Internally Displaced Persons in Africa addresses internal displacement by

[3] WIM makes references in its second five-year rolling work plan to migration, displacement and relocation and more broadly to building capacity. The UNFCCC Task Force on Displacement was created at COP21 to support implementation of WIM. For more information see Annex I, Second five-year rolling workplan of the Executive Committee of the Warsaw International Mechanism, FCCC/SB/2022/2/Add.2.

armed conflict, as well as climate and environmental factors, natural disasters, and development projects. The Convention sets a precedent as the first and only legally binding agreement of its kind protecting those internally displaced by violence, conflict, natural disasters, and climate change (UNHCR, 2022). With regards to connections to peace and/or security, the African Union Commission has consistently addressed climate interconnections in resolutions of the Peace and Security Council. It launched its Common African Position on Climate, Peace and Security at COP29. Sub-regional efforts culminated in the Bamako Declaration on Climate Security in 2022. The Pacific Island Forum Secretariat has consistently recognized climate as the greatest threat to regional security, including in its Boe Declaration on Regional Security.

Pacific Small Island Developing States, like Fiji (2022), Vanuatu (2018), and the Solomon Islands (2022), are amongst the first globally to develop national guidance documents on climate-related relocation. Apart from "reducing the triggers of displacement," Vanuatu's National Policy on Climate and Natural Disaster-Induced Displacement identifies challenges, including the risk of forced evictions and violent conflict due to relocation, while stressing the need to prepare for different displacement scenarios. In terms of "systems-level interventions," the need to "invest in capacity-building and training for all stakeholders to promote understanding of the policy and increase sensitivity to displacement issues" is identified as one of four overall strategic areas (Government of Vanuatu, 2022, page 29). Noting that mobility, in all its manifestations, is not an unfamiliar phenomenon to the archipelago, the Solomon Islands (2022) stresses the application of Standard Operating Procedures, the availability of information, while highlighting such risks as social tensions and preservation of Indigenous knowledge.

The publication of Fiji's (2022) Planned Relocation Guidelines was quickly followed by Standard Operating Procedures a year later, which covered extensively aspects of procedure, implementation, and financing. Recognizing relocation as a traumatic experience, capacity building of communities is stressed in the context of relocation planning and for the effective implementation of the processes outlined. Other developments in the region include Tuvalu's groundbreaking agreement with Australia, the Falepili Union, which includes climate change resilience and mobility with dignity, and safeguarding security.[4] The treaty opens a "special migration pathway" whereby up to 280 Tuvaluans may live, study, or work in Australia. As new policy breakthroughs address increasing climate mobility impacts overcoming gaps in capacity is critical to success. Capacity development and education should adapt in response.

[4] For the full text, see: Australia Government – Department of Foreign Affairs and Trade (no date). Tuvalu - Australia-Tuvalu Falepili Union.
https://www.dfat.gov.au/geo/tuvalu/australia-tuvalu-falepili-union

Policy Recommendations

An Examination of Capacity and Capacity Development in the Realms of Climate, Conflict, and Displacement

Climate is largely rejected as the primary cause of conflict and displacement in policy and research. However, given the "multiplier" effects (CNA, 2007) of climate change on conflict in many geographies around the world, there is a need to consider climate responses as they relate to these social phenomena and vice versa. With increased levels of conflict and global warming, the capacity for climate policymaking needs to reflect the different realities of conflict and displacement-affected contexts. Experts acknowledge that migration and displacement will likely increase with climate change, either pre-emptively to avoid harm or post-facto, as a coping strategy, and the need to avoid the adverse outcomes related to ad-hoc resettlements (Walelign et al., 2021). Addressing capacity gaps at all levels (Lusthaus et al., 1999) in climate policymaking is critical to the adaptive capacity of conflict and displacement-affected countries and remains a hurdle to overcome in addressing their access to climate finance. In this regard, the following recommendations are made:

To understand the need for differentiated climate capacities in developing countries vis-à-vis conflict and displacement-affected settings. Capacity development in the context of climate policies and financing has been consistently tackled over the years, *but* without addressing conflict and displacement. When the two are addressed, it is often in a siloed manner, i.e., climate-related displacement vis-à-vis that which is conflict-related. Capacity development and education play an important role in addressing these gaps. There is a need to consider those who are multiply displaced, i.e., by a combination of climate and conflict. The argument of climate, development, and poverty impacts is well-established. However, a distinction can be drawn between low-income countries and those affected by conflict and/or fragility. An estimated 70% of fragile states are Least Developed Countries (LDCs); some 50% of LDCs are included in the World Bank's Harmonized List of Fragile Situations (UNDP, 2021; Wong, 2023). Conflict has been found inter alia by the Organisation for Economic Co-operation and Development (OECD) to cut across all income levels, including high-income countries in the Middle East and middle-income countries in other regions.

Greater investments in dedicated climate capacities, climate education, and climate capacity assessments in conflict and displacement-affected countries. In response to increasing climate threats, an analytical paper on "Institutional Capacities for Climate Action" developed by OECD (2003), key recommendations: the need for a coherent view of institutional capacity, a minimum level of specific capacities for climate policy, and detailed national capacity assessments. While country specificity is mentioned, there is no specific argument given concerning fragile and conflict-affected countries and territories. However, the authors do assert that "all dimensions of institutional capacity

deserve attention." As an extension of this argument of minimum levels of capacity for climate policy, the case for greater investments in climate-specific capacities and climate education could be made in the case of contexts affected by conflict and fragility. Particularly, as the World Bank Group and UN (2018)'s *Pathways for Peace* notes, the prolongation in the duration of conflicts since the 1970s and the findings of recent research by the International Institute for Strategic Studies (2020) establishes the average duration as having increased from 16 years in 1990 to 30 years in 2020, with increased recurrence noted, as opposed to new conflicts. It is recognized by scholars that peacebuilding is a complex and lengthy process, frequently spanning many years (Vivekananda et al., 2014) and that the impacts of conflict continue to reverberate long after violence ends (Krampe et al., 2021). A greater understanding and investments are needed for effective capacities in climate policy in the contexts affected by violent conflict, as well as post-conflict situations.

Investing in capacities and climate education in conflict and displacement-affected contexts to help address some of the chronic issues related to their access to climate policy and finance. Recent research, including that of UNDP and the Climate Security Mechanism (2021), addressed for the first time trends in access to climate finance in conflict-affected and fragile contexts and gaps and recommendations to make climate finance work more effectively in contexts affected by conflict and fragility. The metadata analysis of 955 projects (US$14.4 billion) implemented in 146 countries, including 56 fragile states, revealed that conflict and fragility may affect access to and implementation of climate finance. From 2014-2021, it identified that of the top 20 fragile state recipients of vertical fund climate financing, just two were extremely fragile, the DRC at 15th, and Haiti at 19th. Projects supported by the vertical funds in extremely fragile states were far smaller than in fragile or non-fragile states (UNDP, 2021; Wong, 2022). Access to financing mechanisms should be strengthened, but may not be effective without the strengthening of endogenous capacities in tandem. Investments in capacity and education need to be part of the longer-term solution to close gaps.

Maximizing opportunities in the climate change negotiations to address climate impacts on displacement and conflict in existing capacity building outcomes. The climate change negotiations did not include gender or adaptation at the outset, but have evolved continuously to encompass both, along with a wider range of issues as they relate to climate. This, after 27 years of loss and damage financing. The 2001 Marrakech Accords saw the creation of a framework for capacity development and COP21, the Paris Committee on Capacity-Building. Capacity development features as a key component of the *Paris Agreement* (Article 9.4), which recognizes that LDCs and Small Island Developing States (SIDS) have "significant capacity constraints" and are particularly vulnerable to climate change. Capacity is highlighted together with finance and technology as one of the Means of Implementation (MOI) of the Paris Agreement. Article

11 of the 2015 *Paris Agreement* commits Parties to the broad objective of "enhancing the capacity and ability of developing country Parties, in particular countries with the least capacity, such as the least developed countries" (UNFCCC, 2015, page 15). Various NDCs already address conflict and displacement (UNDP, 2020). There are opportunities to strengthen climate outcomes in conflict and displacement-affected countries through existing capacity initiatives.

Opportunities for academia and the education sector in climate, conflict, and displacement capacity development. In the case of climate and conflict policy and practice, a focus on institutional capacities is still fairly recent, as are capacity development initiatives in multilateral spaces. Whereas there are clear gaps in institutional capacity, as evidenced by lower access to climate policy and finance by countries affected by conflict and displacement, and a key role where academia can be better engaged. Countries and regions most affected by climate, conflict, and/or displacement arguably show key advantages, and participatory approaches to capacity development remain key to advancing implementation science. In this regard, Hugo (2008) attributes the lack of research to challenges of interdisciplinary approaches and argues greater understanding is needed of future trends. In countries suffering from climate, conflict, and displacement, universities and the education sector - "as some of the most sustainable institutions in the world" according to Huq (2016) - can serve as key partners from perspectives of institutional and participatory approaches to capacity building. As policy and practice have moved beyond addressing climate and development interlinkages to climate interlinkages with sustainable development, climate and environmental education arguably need to make similar advances. With their networks rooted in local contexts, they can help fulfil the aspiration of domestically driven capacity development.

Conclusion

This article reviews literature and practice from the Climate, Peace and Security field, comparing and contrasting with that on climate mobility and displacement, to examine how capacity development and education are treated and to offer practical recommendations for policymakers, donors, and climate finance institutions. When considering capacity and capacity development for climate, an argument of difference needs to be made in conflict-affected and post-conflict contexts, as well as those affected by displacement. In the literature on climate, conflict, *and* displacement connections, the theme of capacity is referenced recurrently. This is often in a static and limited manner, although limited capacity to adapt to climate change, and/or weak coping capacities, are referenced in response to climate shocks and stressors. While the literature stresses capacity development, it does so by focusing primarily on the capacities of vulnerable communities, where investments are most critically needed. However, without

investments in institutional and systemic changes, as well as education in tandem, impacts may often be unsustainable in the face of climate change. While changes in global climate governance and finance are needed, they will not be effective without investments in dedicated investments in capacities.

In the Climate, Peace and Security and the climate displacement fields, the subjects of capacity and education are largely neglected. There remains a limited systematic understanding of capacity and institutional capacity development in the Climate, Peace and Security field, and sparse references to education. Addressing capacity development needs is a critical adaptation that can serve as a lever to close gaps in access to climate finance. At the level of the UN, in practice and the *Paris Agreement*, understanding of climate impacts on displacement arguably exceeds that of conflict and insecurity, and there persists a lack of specific attention to the capacity development needs of conflict and displacement-affected contexts. Capacity is sorely needed but remains underinvested in developing countries, without taking into account the needs of those affected by displacement and conflict. While the IPCC addresses the two other MOIs of technology and finance in its *Sixth Assessment Report*, capacity development is missing, though many, including Klinsky and Sagar (2024), argue that it is foundational to the other two MOIs and can explain persistent implementation gaps.

In the climate field, the challenges of avoiding the two extremes of determinism and reductionism (Hulme, 2011) are manifestly obvious in the parlance of policy spheres. While there is increased intensity in debate on climate as it relates to conflict and displacement, much of the discussion still relates to proof of concept. It is largely driven by investments in data, analytics, and assessments, or the hot topic of finance, without addressing root causes, including capacity needs and climate education shortfalls.

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Ecopedagogy as a Lever for Climate Justice Towards a Just Transition

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The article explores critical learning pedagogies focusing on ecopedagogy and emphasizing the importance of adopting a Freirean approach to learning as a lifelong commitment to promoting civically engaged and responsible climate action. It moves beyond the conventional standardised methods of environmental education taught in formal institutions with structured syllabi and courses. The article highlights ecopedagogy as a learning philosophy integrated through grassroots actions. We discuss selected global issues, threatening biological, social, and environmental marginalization, as case studies to inform the article's dialogue. We examine the definition and interpretation of ecopedagogy in the context of Paulo Freire's vision. We conceptualize ecopedagogy as a pathway to achieving a Just Transition, described as a framework that ensures workers and communities are not left behind as economies shift to sustainable practices. It focuses on fair wages, new job opportunities, and social support for those affected by changes like the move away from fossil fuels. The article proposes a framework that connects ecopedagogy with Just Transition through humanization and critical consciousness. To inform the non-existence of a uniform vision for what just transition entails (Cha & Pastor, 2022), we provide practical applications of this framework in policy and practice, offering recommendations for reconstructing education by implementing ecopedagogy in community-based settings to reconstruct policy aligned to Just Transition.

Keywords: Ecopedagogy, Just Transition, India, Malaysia, United States (U.S.).

Introduction

The Earth is witnessing the climate crisis looming large, interwoven with deep-rooted social and environmental injustices across international, national, and subnational levels. The burden of this crisis falls most severely on the poor and marginalized communities (Kashwan et al., 2020). The limitations of globalized, standardized, top-down solutions

become increasingly apparent. Addressing the polycrisis of climate change, biodiversity loss, and social-environmental injustices requires not only planet-focused technological innovation but also a fundamental transformation in how we learn to understand our place within the wider web of life and humans' role towards the inhabitants of planet Earth. Conventional environment teaching and learning paradigms fall short in fostering the critical awareness and collective action required to address the systemic roots of ecological degradation and inequity.

This article explores ecopedagogy—a critical educational approach grounded in Paulo Freire's (1970/2017) principles' awareness about social injustices and praxis through pedagogy—as a vital lever for achieving climate justice (Misiaszek, 2025). We put forth ecopedagogy and explain its relevance to climate justice, specifically towards 'just transition'. Just Transition (JT) is a concept popularized by United Nations (UN) agencies to bring forward a common global vision around decarbonization, green jobs, and net zero. JT emphasizes the need for a just and equitable shift from extractive industries to sustainable "green" ones (Stark et al., 2023). A JT, as defined by the UN International Labor Organization (ILO):

> Conceptual framework in which the labor movement captures the complexities of the transition toward a low-carbon and climate-resilient economy, highlighting public policy needs and aiming to maximize benefits and minimize hardships for workers and their communities in this transformation.

We argue that for a shift toward sustainable economies to be fair and equitable, JT should include work toward deep shifts in consciousness and civic engagement. It is marginalized communities that are most vulnerable to the environmental crises. When it comes to top-down policy or global agendas, it is the minorities who get left out or unheard. We propose an ecopedagogical framing of JT to prevent the sidelining of those who are marginalized or on the brink of marginalization.

Ecopedagogy, with its focus on critical reading of the world, humanization, and conscientization, provides the essential ethical and practical grounding for operationalizing a JT. We will first delve deeper into the theoretical underpinnings of ecopedagogy, drawing connections to Freirean thought. We will analyze illustrative case studies from the authors' local contexts—including challenges related to air pollution and waste management in India, deforestation impacts in Malaysia, and wildfire crises in the U.S.—to ground the discussion in real-world struggles and potentials. Following this analysis, we propose a conceptual framework linking ecopedagogy and JT, concluding with practical recommendations for implementing ecopedagogical approaches in community settings and shaping supportive policy interventions.

Ecopedagogy for Systemic and Participatory Change

Ecopedagogy is an educational approach grounded in Brazilian pedagogue Paulo Freire's popular education and critical pedagogies, which critically examine how

humans perceive themselves concerning the Earth and nature in this interconnected and relational world (Misiaszek, 2022). It incorporates ecological and sustainability concepts into teaching and learning practices, whether in formal, informal, or non-formal spaces. It represents a holistic approach to education that seeks to cultivate ecologically-minded global citizens equipped to address complex socio-environmental challenges with a perspective that is not anthropocentric, but Earth-centric, which includes all ecological and social systems (including human systems) (Misiaszek, 2022). Raising awareness towards issues is an integral dimension, as is developing planetary consciousness that fosters action towards earth-justice (encompassing social, environmental, economic, and other justices). Recognizing the interconnectedness of ecological degradation with social, political, and economic injustices, and an ecopedagogical reading of the JT brings us closer to ending such injustices and human dominance over nature.

Rooted in Paulo Freire's critical pedagogy (Freire, 1970/2017), ecopedagogy is aligned with the UN Sustainable Development Goals (SDGs), particularly those addressing quality education (SDG 4) and climate action (SDG 13). Ecopedagogy promotes the reading and re-reading of the intersections of social, political, economic, and environmental systems (Misiaszek, 2023). Ecopedagogy helps unmask justice-oriented sustainable notions of resilience, adaptation, and mitigation often neglected under the underlying power structures and injustices (see Baker, 2019; Mahdiani & Ungar, 2021; Rahman et al., 2023). We use an ecopedagogical framing in the context of JT as a tool for deconstructing these narratives and exposing how they can perpetuate the status quo.

Consider the concept of adaptation to climate change. While formally defined and promoted globally by the UN as a critical component of the long-term response to climate change, aimed at adjusting systems and behaviors to protect people, livelihoods, and ecosystems from climate impacts, its practical application may not be universally beneficial. As Mahdiani and Ungar (2021) suggest, adaptation can have a dark side, potentially reinforcing existing inequalities or even creating new vulnerabilities. In real-world situations, adaptation manifests differently across socioeconomic lines. For affluent segments, adaptation could mean creating safe micro-environments, insulating themselves from climate change impacts, while for those who cannot afford this luxury, adaptation could take a devastating form of forced endurance and increased physical burden. Academics must highlight these issues with real-world examples to build collective action towards a true JT.

We use examples from our local contexts, uncovering the underlying and inherent issues that come with JT. These are not representative of the Global North or South or the planet as a whole; we put forth in academic dialogue the nuances that could be relevant across nations and must be understood to meaningfully bridge toward building planetary consciousness and transition into an earth-justice-oriented society. The case studies link ecopedagogies and the various pathways in which they could be implemented for moving towards JT.

The case studies related to air pollution and waste in India, the destruction of the forests in Malaysia, and the fires in Los Angeles, U.S., explain the realities people face in various geographies and showcase the potential that ecopedagogies have to reshape environmental education towards action and JT. The case studies have certain underlying commonalities: the marginalization of communities, the loss of/to humans and nature, and that these issues might appear to be specific to a place, but in reality have global implications. Lastly, these case studies have hidden connections between economic, social, and environmental spheres.

Ecopedagogical Framing of Cases from India, the U.S., and Malaysia

Air Pollution in North India: Who Are the Marginalized? The Planet and Its Inhabitants

New Delhi and the surrounding metropolitan area, home to approximately 55 million people, had the world's worst air pollution in 2024, according to IQAir[1], a Swiss company that measures air quality (Zhuang, 2024). The reading on its index rose to over 1,600 in November 2024. Anything above 301 on that index is considered hazardous, potentially leading to severe eye and throat irritation and serious heart and lung conditions (Zhuang, 2024). The U.S. Environmental Protection Agency considers anything above 500 to be high. Schools were asked to close due to the risk of children falling ill from the air pollutants in Delhi. However, daily wage earners in Delhi do not have the luxury of shutting down shop and staying indoors. These individuals at the lower end of the economic spectrum are the ones who suffer the most. According to the Labor Bureau (2024), there are more than 71,000 individuals who are in the informal sector, earning a minimum wage without any benefits. These people are at the most risk of life-threatening environmental exposure due to the jobs they have. There is no respite for these individuals; meanwhile, others with better economic backgrounds, in the same geographic location, are shielded from the poor air quality to some extent with their windows closed and their air purifiers on. In rich neighborhoods in New Delhi, it is a common sight to see air conditioners functioning all day, whereas on the streets, we see drivers, daily wage earners, and street vendors who are engulfed in pollution and heat with no respite. The environmental experiences vary with the income level. Exposure to pollution is self-selecting, causing more harm to the marginalized.

Callo-Concha and co-authors(2013) presented a conceptual tool that shows how the non-marginalization of humans cannot be achieved by focusing on one aspect alone, such as creating income-generating opportunities or guaranteeing an improvement in living conditions. Humans have failed to live with nature. The livelihood of fishermen is

[1] The Air Quality Index measures the density of five pollutants in the air: ground-level ozone, particulates, carbon monoxide, nitrogen dioxide, and sulfur dioxide. It was established by the U.S. Environmental Protection Agency as a way to communicate to Americans the state of the air they are breathing each day. There are pollution monitors at more than 1,000 locations across the country.

getting harder due to a lack of fish near the coastal region (Pandey, 2025). How humans set boundaries between nature and our economic means requires reflective practices between nature and human beings. Adopting an ecopedagogical framing will allow policymakers to commit to civically engaged and responsible climate action. Ecopedagogy takes us away from a more standardized (Iftekhar & Misiaszek, 2019) approach to planetary issues by uncovering inherent systemic issues that are not just related to the environment but are also affected by socio-economic and cultural factors.

Ecopedagogy promotes learning from real-world cases through dialogue that offers a fruitful opportunity for policymakers and educators to grasp and apply concepts in their organizations and communities. Utilizing ecopedagogy to critique and respond to location-specific issues has the potential to open up pathways for a JT in a truthful manner. JT must ensure that the most vulnerable workers and communities are supported while industries shift toward sustainability. Moving to JT will lead to a rethinking of economic means for many, thus the process would protect and empower the marginalized. A shift towards sustainability, or including measures that may be green, needs to be critically looked at, as illustrated by the situation.

"The dust is like a bedsheet," declared Rohit Mishra when describing the soot that comes from the Timarpur-Okhla Waste to Energy Plant in Delhi, India (Abi-Habib 2024). Hazardous levels of toxic substances have been found near the facility, which turns mountains of trash into electricity. Timarpur, Sukhdev Vihar, and Khadda colony neighborhoods in Delhi have a 200-foot pile of garbage that looms over them. The 20-story garbage pile will collapse on the people of Timarpur or catch fire (Abi-Habib, 2024). The Delhi State Government has placed a state-of-the-art plant there to burn the garbage to create green energy. The plant has produced many environmental challenges, including ash dumps and soot layers near the homes, as well as smoke and toxic soil. These neighborhoods have Arsenic levels 10 times higher than the EPA guidelines, which may cause respiratory, vascular, and cardiovascular diseases (Abi-Habib, 2024). Among other elements in the air is Manganese, which is 11 times higher than the EPA guidelines and can lead to Parkinson's disease. Cadmium is 19 times higher than the EPA guidelines and can, with prolonged exposure, lead to toxic effects on the skeletal system and other bone diseases.

A large part of exercising ecopedagogy is to organize and to fight (through dialogue, advocacy, and action) against local injustices. The residents, who were the most vulnerable to the adverse effects of the sustainability initiative, sued the plant to stop its operations, and the case is still pending in India's Supreme Court. The residents have appealed to the UN; however, they were told that the case is in the Indian Government's jurisdiction. Abi-Habib (2024) mentioned that it was the buyers' responsibility to create so much waste. Such a situation is an example of a green initiative yielding results at the expense of a local community. Ecopedagogy is about educating the masses and guiding people towards a fairer and just circular economy, a system to maximize resource

efficiency and reduce waste. It provides companies and governments with a toolkit to evaluate the effectiveness of initiatives that are meant to bring a positive change.

Wildfires in the U.S.: Re-reading of Climate Disasters for Planet Justice

Wildfires are no longer restricted to California. Dry spells occur in many parts of the U.S., threatening places such as New Jersey and New York. Fires swept through at least 5,000 acres of land for 10 days and impacted towns on the New York-New Jersey border (National Drought Mitigation Center, 2025). Hundreds of trees burned down, including the animals that lived in them. 41.67% of the U.S. and 49.84% of the lower 48 states were in a drought the week of January 15–21, 2025 (National Drought Mitigation Center, 2025). These dry spells make the conditions for wildfires more vulnerable. The unusual severity of these wildfires can be attributed to several compounding climate-related factors. The region has received below-average rainfall, and warmer winter temperatures have further dried out vegetation, making the landscape more flammable than usual (National Drought Mitigation Center, 2025). Strong winds during the winter season accelerated the spread of the flames, making containment efforts especially difficult for fire crews. These conditions reflect a growing vulnerability in the Northeast to climate-driven weather extremes. The impact on local communities was significant. Thick smoke reduced air quality across several counties, posing health risks, particularly to children, the elderly, and individuals with respiratory conditions. Schools in the affected zones were forced to close temporarily, and some major roads were shut down due to poor visibility and fire proximity (Associated Press, 2025). Beyond the immediate threat to human life and property, the fires caused long-term damage to ecosystems, including the destruction of habitats for native species and scorched areas of protected forestland that could take years to recover (McKay & Oladipo, 2025).

This event highlights a troubling trend: drought-induced wildfires are no longer confined to the western U.S. As climate change accelerates, it causes shifts in regional weather patterns, resulting in increased fire risks in places previously considered low-risk (Parshley, 2025). This reality calls for urgent action. State and local governments in the Northeast should revise their emergency preparedness and disaster response strategies to account for wildfires. Investments in forest management, early warning systems, and public awareness campaigns are essential. A coordinated, multi-state approach to drought monitoring and climate resilience could play a vital role in adapting to this emerging challenge. With ever-increasing drought and wildfires along with unseasonal rains, landslides, and rising temperatures, ecopedagogy gives an earth-focused lens to connect to climate change and not consider these climatic disasters a one-season or one-off incident to ignore (Marcius 2024, November 17).

A JT needs to build awareness not only from a standpoint of justice towards humans from the consequences of human actions, but from a standpoint of ecojustice, or justice towards the planet, and vice versa. The wildfire crisis along the New York–New Jersey border underscores the growing impact of climate change in traditionally temperate

regions and reinforces the need for a JT—one that acknowledges the intersection of social justice and environmental responsibility. A JT must go beyond protecting human livelihoods and include a commitment to ecojustice, which recognises the planet's intrinsic rights and the need to restore balance between human activity and natural ecosystems. The path forward must involve building awareness and action that reflects justice toward both people and the planet, recognising that the two are inseparable in the pursuit of sustainable development.

Developing knowledge of planetary justice through an ecopedagogical lens establishes a strong foundation for meaningful dialogue and action toward a JT away from fossil fuel dependence and environmentally harmful practices. In the context of events like the New York–New Jersey wildfires, ecopedagogy encourages students to analyze the scientific causes of drought and fire risk as well as to reflect on their roles as ecological citizens. It challenges traditional, anthropocentric narratives of education, fostering a sense of shared responsibility toward the Earth, highlighting the moral imperative to care for human communities and natural systems. Integrating ecopedagogy into curricula, educators can cultivate awareness, values, and an action-oriented mindset to navigate the complex realities of the climate crisis and contribute meaningfully to a just and sustainable future (Misiaszek, 2020; Kopnina & Cherniak, 2016).

Orang Asli Community of Malaysia: Raising Consciousness from Communities

A total of 1,074 permanent forest reserve areas in Peninsular Malaysia, equivalent to 38,376 hectares (over 53,700 football fields), were illegally cleared as of December 31, 2023 (Abd Malik, 2024). However, the destruction of forests in Malaysia is not confined to illegal activities. As land is under the sole jurisdiction of each state, states can legally degazette permanent forest reserves for activities such as logging, agriculture, plantations, mining, and property and infrastructure development. The biggest victims are the Indigenous people, known as the Orang Asli.

> If you compare us with the rich city folk, then, of course, we would seem poor. But we are not starving. We are still able to feed our families, and we are happy with the way we lead our lives here. But deforestation is threatening our survival and way of life. We can't farm, we can't fish, and much of the forest land is taken, making it hard to find materials to practice our rituals. How are we supposed to live? (Wan Razali & Mohamed (n.d.).

The above excerpt is from the case of Gua Musang in Kelantan, Malaysia, which has seen severe land destruction. For the Orang Asli community, life is linked to ancestral land passed down from generation to generation. Living off the land for the Orang Asli means using land thoughtfully, respectfully, and carefully, with the understanding that it will be passed onto future generations (Wan Razali & Mohamed, n.d.). Indiscriminate and unchecked development has displaced these communities and threatened their survival. Water sources are contaminated by upstream logging and development

activities, causing soil and chemicals to flow into the rivers that the Orang Asli rely on for bathing, fishing, and drinking water. There have been cases of dangerous encounters with displaced wildlife, including tigers and elephants (McIntyre, 2024; Zainudin, 2024). Flooding is a perennial problem, but with lucrative revenue streams at stake, the government has little incentive to stop the source of the problem. It adopts an adaptation approach (evacuation, rescue, and relief)each time the floods come. For decades, the Orang Asli have pushed back, offering to help the state with conservation projects that can contribute to the economy sustainably, but to no avail.

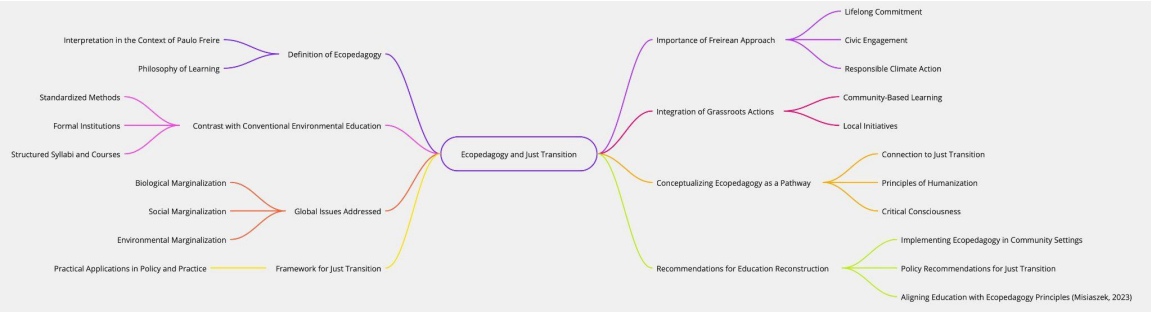
The federal government is responsible for issues of the environment in the Malaysian constitution, including matters of stewardship, conservation, and sustainable use of natural resources. Because jurisdiction over land, water, mining, and forests remains with the state, the federal government can only advise the state but cannot force it to stop making decisions based on what is economically lucrative. Ecopedagogy guides bottom-up dialogue with and the inclusion of those affected. It thereby brings forth alternative solutions that are socially just and still economically valuable in a new, sustainable economy. Measures to improve a community's ecological consciousness need to be social justice-driven and grounded in the local context.

Ecopedagogy: Bridging the Gap to a JT

The case studies discussed above provide pathways that lead to the JT mapped out in Figure 1. Ecopedagogy, as a theory and process, has the potential to bridge gaps on a policy level in pursuit of JT. It does so by examining and questioning, fostering dialogue (inspired by Freire's [1970/2017] concept of communication), and critical and earth-focused assessment (uncovering) of issues to pursue social, economic, political, and environmental justice within the framing of planetary or earth-justice. Ecopedagogy is a lever for climate justice, enabling individuals and communities to engage with the interconnectedness of global issues. It empowers learners to reflect on the causes of climate change and environmental degradation. Such reflection can enable them to challenge structures of inequality that perpetuate environmental harm and to uncover the hidden interconnections between oppressions to counter them.

Figure 1

Mindmap to show pathways between Ecopedagogy and JT



Core components of ecopedagogy (problem posing, equal participation, dialogue, and praxis—that stem from Freire's critical pedagogy) are achievable with: the awareness of the potential of such a framework to guide policy grounded in local contexts; and with both formal and informal educational frameworks encouraging critical thinking, creativity, active participation, and experiential learning to solve problems (Kopnina & Bedford, 2024). Engaging in critical reading, posing problems, and dialogue helps build a comprehensive understanding of various perspectives. These processes then drive action toward solutions and a praxis-oriented approach leading to real outcomes. Hence, these processes contribute to developing a consciousness-based approach to addressing climate injustices (Misiaszek, 2023).

Conscientization, Freire (1970/2017) discusses, focuses on understanding the root causes of issues, for example, climate change and pollution, rather than merely acknowledging their presence to act against oppressive realities. Rahman and others (2023) explained how top-down approaches may be oppressive when it comes to agenda-setting and may include hegemonic power dynamics, which lead to injustices locally (further marginalising certain communities). This arises when non-local actors and organizations centre the planning on the priorities of donors and certain stakeholders, while not involving communities in decision-making. The disparity of participation and unequal or superficial understandings of local and global action pose a threat to planetary justice. JT should promote bottom-up approaches from an earth perspective rooted in humanisation and conscientization of stakeholders, a process of recognising social, political, and economic contradictions. Misiaszek (2019) underscores how Freirean pedagogies foster an awareness of the underlying causes of environmental destruction and support human actions that promote social and environmental justice as well as planetary sustainability.

Ecopedagogy as a means to provide constructive system critique is based on deconstructing dominant narratives, creating consciousness over solely creating awareness towards issues, and moving away from a rudimentary, predominantly anthropocentric view of the global agendas. This shift is fundamental in recognising our interdependence with nature, a prerequisite for JT. Ecopedagogy emphasises the interconnectedness of all life, and true to the Freirean approach (1970/2017), highlights the importance of protecting the most vulnerable. Ecopedagogy helps establish critical links between climate change, drought, and increased wildfire risk, highlighting the need to restore ecological integrity and balance, envisioning alternative futures that are both just and sustainable. Power imbalances will lead to a failure in the true fulfilment of principles toward achieving JT.

Ecopedagogy as a Lever to Climate Justice

To move to a justice-oriented society, we should understand the notion of development in Education for Sustainable Development (ESD). Whose development is it? Scholars have raised a critical voice that development in ESD implicitly assumes a Western model

of progress (Misiaszek, 2019a; Iftekhar & Misiaszek, 2019; Kopnina, 2020; Jickling & Wals, 2008). A narrow approach to development can lead to the marginalization of Indigenous knowledge systems and alternative visions of advancement (Glavič, 2020).

Development is often treated as a linear line of growth. ESD operates within the framework of sustainable economic growth. This paradigm may be fundamentally at odds with true ecological sustainability, as infinite growth on a finite planet is inherently problematic (Nagata, 2017). ESD may not sufficiently encourage students to critically question the very notion of development itself, instead accepting it as an uncontested good (Nagata, 2017). Such models that do not encourage critical dissection of issues and notions of development can be seen as shallow ecologies (Kopnina & Bedford, 2024). Misiaszek (2019a) put forward the argument of d/Development with an ecopedagogical lens to question development for whom and towards what. How humans define development is a question on its own.

Ecopedagogy's transformative learning through deep reflection on personal and societal values and assumptions can empower individuals to take action for sustainability and social justice. To stop promoting the neo-liberal development ideas linked with ESD, the ecopedagogical lens becomes a critical direction for policy. It will help foster open dialogue about transition challenges, promote critical thinking about long-term planetary sustainability, and encourage innovative solutions to transition-related issues. These elements are crucial for building the broad-based support and engagement necessary for successful transition initiatives. By incorporating these approaches guided by ecopedagogy into education, we can better prepare individuals and communities to understand, support, and actively participate in JT processes. Such a foundation is essential to create an informed, engaged citizenry to implement and sustain the complex changes required for a just and sustainable future.

Shaping Practices with an Ecopedagogical Lens

We need to have a broader approach to environmental education with a social-emotional connection to nature, a critical eye towards the colonial perpetuating factors, and the language to express and connect with others. Table 1 summarizes some key constructs and practices that could guide ecopedagogical discourse in educational settings. A central aspect of the literature on ecopedagogy (Hung, 2017) is its ability to cultivate empathy and forge emotional bonds with nature. Through vivid descriptions and explorations of human-nature relationships, literary works evoke visceral responses in readers (Monem, 2024; Muhsyanur, Murugesan, & Diwakar, 2024). This emotional engagement allows learners to develop an appreciation for the intricate web of life, creating a foundation for environmental stewardship that extends beyond mere factual knowledge (Itle-Clark & Comaskey, 2020).

Table 1

Key Constructs and Guiding Principles Shaping Practices

Key Constructs	Guiding practice reflections
Critical consciousness	Who is getting left out and why? How can community practices be more inclusive?
Action-oriented participation	How can collective bottom-up ideas formulate collective action for social good?
Countering post-colonial tendencies	How can one learn from the culture and heritage, and preserve eco-practices in the community?
Emotional bonding with nature	Collective practices that help us connect with nature at a deeper level.
Cultivating empathy	Cultivating empathy for each other and for nature to help preserve and protect the planet.
Critical Thinking	Collective discussions and dialogue to counteract pollution and other stresses on nature.
Creative Expression	Using art in the community spaces to express gratitude, nature inspiration.

A crucial element of ecopedagogical literature is its capacity to foster critical thinking (Hossain, 2024; Walter & Kluttz, 2021). Presenting diverse perspectives and challenging anthropocentric viewpoints, this approach encourages learners to deconstruct dominant narratives and to examine the ideological underpinnings of environmental discourses (Muhsyanur et al., 2024). This critical analysis process enables learners to develop a nuanced understanding of environmental issues and to confront their unconscious biases, leading to more informed and thoughtful engagement with ecological challenges.

Promoting creative expression is the third key aspect of eco-pedagogical literature (Abed, 2024). It recognizes the power of artistic and written responses in articulating environmental concerns and envisioning sustainable futures (Muhsyanur et al., 2024). By engaging with various literary genres such as poetry, fiction, and personal narratives, learners are empowered to find their voices and to understand others who contribute to the ongoing discourse on environmental issues. This creative dimension enhances the learner's communication skills and allows them to explore innovative solutions and alternative ecological futures. Freire (1994) in *Pedagogy of Hope* proposed to overcome lopsided communication in a non-idealistic but ontological manner by acting in the world to transform oppressive conditions.

The integration of these 3 aspects, emotional connection with Earth and inhabitants, critical thinking towards perpetuating issues, and creative expression to understand the self and others, creates an inclusive approach to environmental education. Transcending common classroom boundaries and embracing diverse cultural narratives, ecopedagogy

helps learners become active changemakers and responsible global citizens (Muhsyanur et al., 2024; Misiaszek, 2019a). This multifaceted approach enhances environmental literacy and fosters a deeper sense of connection and responsibility towards the natural world, paving the way for more sustainable and environmentally conscious societies.

Advocating for JT Policies Grounded in Ecopedagogy

This article advocates for ecopedagogy as a tool to guide policy and practices to help situate our understanding of the world and the community practices as a power to resist planetary oppressions. Using case studies from India and the U.S., Iyengar and Iyengar (2024) suggest that such spaces exist at the township and city levels; however, citizens are not equipped with the skills to inform policy dialogues in the most informed manner. Creating more spaces for dialogues and discussions to co-create knowledge will aid in making the local government representatives more accountable with an informed citizenry (Rhonda, 2013). Physical spaces in towns are re-conceptualised, prioritising the creation of green, accessible public areas that foster community interaction and promote well-being (All Things Urban Team, 2023). Libraries are incorporating outdoor spaces like courtyards and terraces to extend activities beyond the building and connect with the surrounding environment (Pierce, 2021).

Table 2

Key Constructs and Guiding Principles Shaping Policies

Key Constructs	Guiding policy reflections
Creating spaces for dialogues	Cities and Towns need to be reimagined to bring people together in spaces to facilitate informal dialogues
Ecopedagogies in the post-truth era	Critical pedagogies for social media to prevent further polarisation are required.

Table 2 demonstrates that the space for dialogue cannot be restricted to physical spaces. Cultivating ecopedagogical literacies in the era of post-truth is more important than ever, including on social media. As Misiaszek (2019b) states, intensifying post-truthism distorts concepts of development to ignore or falsely justify socio-environmental violence, increase polarization that justifies socio-environmental violence upon them, and ignore or falsify the laws of nature. Examples of this are prevalent on multiple social media platforms and mislead the masses all over the world. Mainstream narratives that lead us away from JT can be countered with ecopedagogical literacy.

Conclusion: JT, the Ecopedagogy Imperative

Equity and inclusivity, cornerstone principles of JT, are addressed by ecopedagogy by recognizing that environmental issues disproportionately impact marginalized communities. This was elaborated in the example of communities in Delhi bearing the

brunt of pollution from the waste plant. In the case of the Orang Asli, Indigenous communities are denied their right to ancestral lands and livelihoods. An ecopedagogical framing of JT would prioritize the rights of these groups, involve them in decision-making, and ensure their benefit (direct or indirect) from conservation efforts or development. JT, from an ecopedagogy perspective, brings the focus to equitable solutions, especially community-based solutions tailored by and towards local needs and contexts, ensuring the JT is relevant and appropriate.

JT requires that vulnerable members in the ecosphere have a voice in shaping their futures and the futures of the natural world. Community empowerment becomes imperative toward prioritizing and voicing the rights of the marginalized. Ecopedagogy fosters participatory approaches and demands accountability on the part of stakeholders to ensure that development is not framed by globalisation from above. Shallow ecological models do not address or critically examine power structures or injustices; for example, in the case of daily wage earners in Delhi severely facing health risks due to air pollution. JT grounded in ecopedagogy would reveal disproportionate injustices to demand pollution control, address health impacts, and provide access to healthcare. Other solutions include transitioning away from polluting industries to prioritize the health and well-being of those who suffer the most, including the communities and the earth. To achieve JT, it is important to debunk the myth that human well-being can be divorced from the Earth's well-being and to carry this dialogue forward.

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Does One Future Matter More Than the 'Other(ed)'? A Brief Critical Analysis of the UNESCO Education for Sustainable Development 2030 Framework

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The United Nations Educational, Scientific and Cultural Organization's (UNESCO) Education for Sustainable Development roadmap (ESD 2030) is a policy document that reiterates the urgency of the climate crisis and affirms the central role of education in ensuring the survival of the planet. Building on nearly two decades of international policy on education for sustainable development, ESD 2030 highlights priority areas and recommendations for integrating education for sustainable development at all levels of society. Despite its urgent call to action, there is little to no attention paid to systemic issues such as capitalism and racism and their role in accelerating the climate crisis. This essay critically analyzes the ESD 2030 framework and makes a case for reckoning with past and present systemic injustice to combat the climate crisis effectively. It examines how modernity has functioned as a justification for colonial conquests and exploitation, and the role of racism in perpetuating the dehumanization that makes such activities possible. While ESD 2030 implicitly attempts to integrate empathy and relationality in its approach to sustainability education, this essay draws from Black critical theorists to argue why relationality should confront racism and racialized violence for it to have an enduring impact in education. The essay spotlights ways in which environmental education is taking a more critical and race-inclusive approach while honoring the principles that ESD 2030 proposes.

Keywords: UNESCO, education for sustainable development, climate justice, critical theory.

Introducing Education for Sustainable Development (ESD) 2030 and the Racism Gap

The United Nations Educational, Scientific and Cultural Organization (UNESCO) rolled out a 73-page framework outlining the road ahead for Education for Sustainable Development (ESD) in 2020. It was built on the work of the Global Action Programme on ESD (GAP) from 2015-2019 and the UN Decade of ESD from 2003-2014. Opening with a powerful call to action that urges everyone to "learn to live differently" (UNESCO, 2020, p. 6), this framework ('ESD 2030') expands on the GAP priority action areas—advancing policy, transforming learning environments, building capacities of educators and trainers, empowering and mobilizing youth, and accelerating sustainable solutions at a local level. It offers critical reflections and recommendations for implementation. ESD 2030 recognizes that environmental education, though typically associated with scientific knowledge of the environment, should evolve beyond a

scientific focus for it to be transformative. It calls for a disruption of "the 'usual' way of thinking, behaving or living" (UNESCO, 2020, p. 18), and emphasizes education as a means of empowering lifelong learners with the skills to build a more just society.

This echoes what environmental justice movements around the world have been taking on in local, national, and global contexts. Examples include movements against the disproportionate hazardous dumping in African-American communities in the United States (U.S.) (Holifield, 2001), Indigenous movements against major eco-conservation organisations to protect their land rights (Survival International et al., 2021), and protests against forced displacement of nearly 7 million people due to illegal mining projects in Eastern Congo (Amnesty International, 2022). These movements have in common the recognition of the threat that exploitative systems pose to livelihoods.ESD 2030's call to action is weakened by its reluctance to name explicitly the systemic injustices it wishes to address. While the framework identifies "the complex mix of social and economic issues" (p. 6), "a gendered facet of vulnerability [to climate change]" (p. 20), "unbalanced economic growth" and "extreme poverty" (p. 57) as some of the critical considerations it must make in delivering education for sustainable development, it fails to hold accountable the underlying systems and institutions fuelling these conditions.

The framework is devoid of any mentions of racism and colonialism. This is part of a history of international negotiations evading explicit recognition of racism and colonialism as significant structures affecting humanity. The creation of the UN and the Universal Declaration of Human Rights saw little to no reckoning with race and colonialism for a few reasons (Acharya, 2022). The creation of the UN was a response focused on the events of the Second World War (Acharya, 2022). Several key drafters were colonialists or complicit in colonialism themselves (Acharya, 2022). The nations that would have been most concerned with colonialism were either not represented in the conferences at all or were represented by the colonial powers ruling them at the time (Acharya, 2022). While it would be remiss not to acknowledge significant strides in anti-racism at the UN, such as the Durban Declaration from the 2001 World Conference Against Racism and the Human Rights Council's Special Rapporteurs on racism, the backlash and boycotts it continues to face from former colonial powers is indicative of the work that needs to be done (Achiume & MacDougall, 2023).

I argue that failing to acknowledge systems of dehumanisation and exploitation in addressing the climate crisis is not only disingenuous but dangerous. ESD 2030 leaves no room for doubt that the climate crisis we face is a "battle for our lives" (UNESCO, 2020, p. 8). The climate crisis is not only a story of emissions and forest cover—these issues are at least partly rooted in historical and ongoing patterns of violence and exploitation (Intergovernmental Panel on Climate Change [IPCC], 2023). Discussions of the climate crisis without reflecting upon capitalism, racism, patriarchy, and colonialism will inevitably fall short. If education is to be a means of driving change, then this framework should reckon with systemic injustices.

Why Do Systems Matter in the Climate Crisis?

A 2024 survey of the IPCC reveals that 86 percent of the 211 scientists estimated a rise in global temperatures of over 2°C above pre-industrial levels by 2100 (Wynes et al., 2024). 58 percent of respondents estimated a 50-50 chance of temperatures exceeding a 3°C rise by 2100 (Wynes et al., 2024). The surveyed scientists identified several factors contributing to the failure of the 1.5°C Paris Agreement target: lack of political will, governmental short-sightedness, corporate interests, and capitalism (Carrington, 2024). The IPCC Sixth Assessment Report (2023) identifies differences in humans' vulnerability to climate change as "driven by patterns of intersecting socioeconomic development, unsustainable ocean and land use, inequity, marginalization, historical and ongoing patterns of inequity such as colonialism, and governance" (p. 51). This calls for a closer examination of the underlying ideologies of modern-day systems and their connection to the climate crisis.

Modernity and rationality, market exchange, and empiricism rest upon the notion that humans are not only distinct from nature but superior to it (the human-nature binary) (Milstein & Castro-Sotomayor, 2020). The origins of this concept can be traced back to thinkers like Descartes and Kant, who posited that all knowledge of the universe existed because the human mind created units of knowledge, and our relationship with nature was an extension of that (Lejano, 2005). What often gets left out of the historical narrative of modernity is the role of colonialism in giving it prevalence (Alimonda, 2019). The idea of modernity was deployed to undermine complex biocultural relations that Indigenous people had with their land and impose a Eurocentric binary model of human-nature relations (Mansilla-Quiñones et al., 2023). This was carried out under the guise of bringing 'progress' and 'development' to so-called savage and uncivilized lands. The distinction between 'civilized' and 'uncivilized' served a particular purpose in the maintenance of colonies. Karl Marx coined the term 'primitive accumulation' to characterise resource extraction under capitalism as a brutal, violent process that the flourishing of capitalist societies relies on. The existence of 'democratic', 'civilized' nations is sustained by the unregulated extraction of resources from "savage spaces and zones" (Hage, 2017, p. 61). The 'progress' narrative was and continues to be instrumental in legitimizing this exploitation in ideological and material ways, allowing intellectual experts and politicians alike to interpret and impose their versions of reality in the name of ushering in the future (Shanin, 1997).

To suggest that the civilized/uncivilized distinction was grounded solely in economic reasons presents an incomplete picture. Pulido (2017) illustrates how capitalism has relied on the appropriation of and denial of access to Indigenous land and the racialization of labour through slavery. These are the two main ways in which racism functions as a "structuring logic of capitalism" (Pulido, 2017, p. 526). Race-making is a process of othering (Omi & Winant, 2014). Othering is a process of disregarding and denuding the humanity of a people (Klein, 2016), which makes it easier to justify the relentless exploitation of land and labour in the name of development. The magnitude of

these historical and contemporary structures cannot possibly be undone through education alone, but it does not mean it is not worth attempting. To quote Freire (1970), "the dehumanization resulting from an unjust order is not a cause for despair but for hope" (p. 91). The first logical step to countering dehumanization is through a framework of education that centers empathy and justice.

Can Relationality in Education Help Us?

Lejano (2023) defines relationality as "the degree to which individuals understand their being, thought, and action as integrated with that of others and, so, make decisions and take action in ways responding to these relationships" (p. 109). Relationality posits itself as an alternative to rationality. Where rationality explains human behaviour in terms of maximising individual satisfaction, relationality makes the argument that human behaviour is also motivated by our relationships and care for each other. ESD 2030 aims to foster this spirit, going by its emphasis on "competencies related to empathy, solidarity and action-taking" (UNESCO, 2020, p. 14), cultivating "core values and attitudes for sustainability" and "empathy and compassion for people and the planet" (UNESCO, 2020, p. 17). It seeks to build on "human rights and principles such as participation, non-discrimination, and accountability" (UNESCO, 2020, p. 58). Despite its reluctance to name racism, its allusions to inclusion and democratic processes imply that it intends to address the possibility of change through a relational approach.

One should question the effectiveness of such an approach in a framework that continually sidesteps and omits the question of race. Black critical thinkers remain skeptical of this universalising call for action and unity that hinges on forgetting the violence in race-making, the othering of black people, and black suffering. Karera (2019) proposes a 'non-relational' approach to the Anthropocene and climate crisis ethics—one that investigates the enduring conditions of colonialism, slavery, and racial capitalism, rather than scrambling to find a prescriptive universal solution. Non-relational does not negate that humans should care for each other; rather, the ethics of care must grapple with the racialized violence and suffering of our systems if we truly want to protect all life on this planet.

What would this look like in education? Stapleton (2019), influenced by the work of Black feminist theorists like Patricia Hill Collins, calls for the application of standpoint theory, which suggests that all knowledge is socially situated, in the practice of environmental education. This includes interrogating how different audiences define common concepts like 'environment', recognising the positionality of educators and learners within unjust systems, and expanding the ideas and thinkers we consider influential to centre knowledge from marginalised communities (Stapleton, 2019). Recognizing that environmental education focuses on climate science and individual action without recognition of social structures, Schindel and colleagues (2023) advocate for a climate-justice-oriented approach that allows learners to engage with climate

justice issues in their communities and for educators to draw connections between local and global issues in the process. They recommend involving learners in local resilience and ecological restoration projects for learners to develop firsthand knowledge of the impact of the climate crisis on their communities and the populations it impacts the most. These are examples of justice-oriented, learner-centric pedagogies that not only make ESD 2030's pedagogies possible but also integrate racial and climate justice in practical, realistic ways.

ESD 2030's idea of progress should move past its imperial legacy and begin with the most marginalized. It should live up to its call to action and allow educators and learners to question what terms like environment, education, and sustainable development mean, and produce knowledge that reflects their experiences. It should center Indigenous voices not only in perspective-sharing, but also in leadership and education. If education is to be liberatory, then humans have every right to call for an attentive, not prescriptive education. An education that accurately reflects the world is an education that will transform it, just as ESD 2030 aims to be.

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Book Review of *Educating for the Anthropocene: Schooling and Activism in the Face of Slow Violence*[1]

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Anthropologist Peter Sutoris's (2022) *Educating for the Anthropocene: Schooling and activism in the face of slow violence* overlaps comparative education, environmental anthropology, and international development studies. Sutoris (2022) focuses on pedagogies for reimagining ecological futures. His book offers a timely and compelling explanation of how the education system should evolve in response to the global environmental crisis. The book is grounded in solid ethnographic work among two Global South communities contextualized as frontlines of the "high Anthropocene" (Sutoris, 2022, p. 10). The book explains how education can prepare humans for life in an era that transcends apolitical knowledge transmission, calling for education to cultivate empathy, conviviality, and inspire activism as a means for radical environmental action. The book brings into conversation important scholars, including Paulo Freire (1970) and Rob Nixon's book *Slow Violence* (2017).

At the heart of *Educating for the Anthropocene* is the message that education about the environment can be enhanced through radical imaginaries- creating political subjects that give agency to young people as activists and changemakers. Instead of obsessing about economic growth, education can help young people grasp and confront the crisis through the lens of local society, culture, and politics. Sutoris (2022) proposes that activism should be central to education and that activists should be recognized as educators. This shift is critical to imagining a better future. The book advocates for an interdisciplinary curriculum from Science to Humanities that will empower students to understand environmental issues and act prudently. The book challenges the polarization of environmental education taking place through Environmental and Sustainability Education (ESE), focusing on two ethnographic case studies. Such analysis shows how education should be refashioned and repoliticized. As Sutoris (2022) states, "this book, then, is an ethnographic exploration of schooling and activism in relationship to slow violence in the context of intergenerational legacies of colonialism, racism, and environmental degradation" (p. 10).

As an educationist trained in ethnography, Sutoris (2022) peeks into the life narratives of children and activists in India and South Africa confronted by pollution, toxic waste, legacies of colonialism and racism, big dams, and postcolonial development. Using critical pedagogy as a framework, Sutoris (2022) advocates for education as a transformative process, an act of dialogue that triggers social change. His engagement with activists and children in Pashulok (India) and Wentworth (South Africa) presents a dialogical exchange with young people who call for social and environmental justice through creative collaborative ethnographic practices like

[1] Sutoris, P. (2022). *Educating for the Anthropocene: Schooling and activism in the face of slow violence.* MIT Press.

filmmaking (visual anthropology) combined with oral interviews. Through the case studies and life histories, Sutoris (2022) makes a compelling case for bridging schooling and activism in education for the Anthropocene.

A strength of the book is its use of diverse case studies illustrating the depoliticizing effects of mainstream schooling. Stories use powerful images and narratives to describe how the slow violence of dispossessions and displacement caused by the construction of the Tehri Dam shapes environmental action in the Himalayan region vis-a-vis industrial pollution in South Africa. The case studies highlight how environmental education in the Global South is framed as a tool for awareness-raising and to address social justice, community cohesion, and activism.

The book is ethnographically rich with illustrative photographs and vignettes. Several education systems in the Global North remain heavily focused on neoliberal pedagogic practices, standardized testing in curriculum design, which often hinders the integration of transdisciplinary, activist-driven approaches to learning. A more in-depth analysis of how Sutoris's ideas could inform educational policy and practice in these contexts would strengthen the book's transregional impact on ESE studies. The book offers a clearer path toward implementing his anthropological vision for educating in the age of anthropocene across diverse cultural settings, given the fact that climate change is a global and local phenomenon.

Sutoris (2022) pays attention to traditional ecological knowledge (TEK), documenting efforts to integrate Indigenous ecological knowledge into formal education and schools. The book ties ecological education to the broader conversation about decolonizing education, resonating with Global South decolonial and post-colonial scholars such as Linda Tuhiwai Smith (2012) and Ivan Illich (1971), who argue for the inclusion of Indigenous perspectives in our pedagogic practice through deschooling mainstream education and through tools of conviviality. Exploring these alternative knowledge systems and the power of activism, Sutoris (2022) opens up important discussions about the role of education in revitalizing Indigenous ecological practices and challenging colonial violence and the hegemony created by the Eurocentric industrialization-based growth and high modernist development agenda. The book also brings into conversation the writings of important Global South voices such as Ashish Nandy (2015), who speaks about the decolonization of the mind and its importance in revitalizing education that focuses on important questions of equity, environmental, and intergenerational social justice issues.

In its concluding chapter, Sutoris (2022) advocates three apparatuses for education in the age of the Anthropocene. The radical imagination focuses on the possibility of care and conviviality beyond bureaucratization and depolarization of environmental issues. He advocates for agonistic pluralism wherein the scope for bringing into conversation opposing worldviews is possible. Thirdly, he proposes the question of intergenerational dialogue, focusing on ecological and environmental debt that we owe to our future generation and our responsibility toward the care and stewardship of our environment. Sutoris (2022) concludes with the observation that "there is a

finite earth threatened by humanity's thrust for infinite growth- and that is why we need to talk about educating for the Anthropocene" (p. 208).

Equally significant is Sutoris's (2022) emphasis on retraining teachers with a political vision that embodies activism and grassroots action from schools that lends agency to young people and a voice to challenge the depolarization carried out by the state. He envisions educators not simply as knowledge transmitters but as facilitators of critical dialogue and reflection on ecological issues that are environmental, social, and political. Schools, he argues, must create spaces where students can engage deeply with the ethical and practical implications of ecological crises. ESE should prioritize creativity, sensitivity, and conviviality to prepare educators to navigate the complexities of teaching and learning in the Anthropocene.

Educating for the Anthropocene is a well-timed and stimulating book, making a case for the reimagining of education in the face of the global challenges created by human greed and capitalist high modernization. Through his advocacy for empathy, care, and conviviality, Sutoris (2022) reflects on the role of education in fostering critical pedagogy, interdisciplinary learning, and activism. Stories offer a hopeful vision for how education can contribute to addressing the crises of the Anthropocene. While the book contributes to the field of environmental anthropology and critical pedagogic studies, its scope is limited to a thick descriptive account and in-depth case study rather than broad generalization for framing education policy.

As an advocate of degrowth and alternative environmental activism, Sutoris (2022) invites educators, changemakers, and activists to rethink the role of education by focusing on what and how they teach, the book offers a persuasive, ethnographically rich chronicle with activism at the heart of agonistic pluralism capable of confronting the environmental challenges ahead.

Debojyoti Das *is an anthropologist and geographer by training with a research focus on the Global South and a strong commitment to sustainability education. With over ten years of experience in teaching, research, and academic scholarship in the United Kingdom higher education sector, Das has worked to embed sustainability principles into both curriculum design and student engagement. Das has designed and led summer schools, field trips, and interdisciplinary workshops that integrate critical pedagogy with sustainability themes, encouraging students to explore global and local challenges through multimedia projects and experiential learning. Das believes in practice-based, 'learning-by-doing' approaches, which have proven effective in deepening students' understanding of complex environmental, sustainability, and development issues.*

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Book Review of *The Ages of Globalization: Geography, Technology, and Institutions*[1]

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Introduction

Economist Jeffrey D. Sachs in *The Ages of Globalization: Geography, Technology, and Institutions* (2020) challenges conventional narratives of development, presenting a historically informed account that interrogates the interactions between geography, technology, and institutions. Unlike traditional approaches that often privilege Western perspectives (Held et al., 1999; Steger, 2013; Rizvi & Lingard, 2010), Sachs (2020) draws diverse lessons from seven eras of human history. This approach invites critical examination of how globalization has shaped and continues to shape education.

Objectives

This review engages with Sachs' (2020) work through the lenses of critical pedagogy (Freire, 1970; Tewell, 2015) and decolonial critiques (Mignolo, 2009; Tamale, 2020), examining how his historical appraisal of globalization can inform more equitable and contextually responsive approaches to comparative education. By challenging the universal narratives frequently embedded in globalization discourse (Connell, 2007), this analysis highlights the potential for reimagining educational practices that recognize diverse knowledge systems and ways of understanding the world. Scholars have advocated for increased cultural and contextual sensitivity in educational research to enhance its contributions to theory, policy, and practice (Crossley & Watson, 2003). This review contributes to comparative education by demonstrating how historical frameworks can guide cross-cultural educational approaches. In doing so, it builds on Arnove's (2007) dialectical analysis of global and local forces shaping education systems and Spring's (2008) examination of the globalization of education.

Outline of the Book

Sachs (2020) divides human history into seven ages of globalization characterized by interactions between geography (physical constraints and opportunities), technology (tools and innovations), and institutions (social organizations and governance structures). This tripartite framework offers a valuable vantage point for comparative education, as one can examine how different educational systems are shaped by these factors and how educational collaborations can address pressing global issues.

[1] Sachs, J. D. (2020). *The ages of globalization: Geography, technology, and institutions*. Columbia University Press.

Departures from Traditional Frameworks in Comparative Education

Sachs' (2020) historical approach offers a distinct departure from world culture theory and dependency theory in comparative education. World culture theory explains the cultural impacts of global convergence through a neo-institutionalist lens, emphasizing the rationalization of change driven by isomorphism (Silova & Brehm, 2020). The book's framework embraces complexity by examining the interplay of geography, technology, and institutions across seven historical ages, allowing for a more nuanced understanding of how local contexts influence and adapt to global forces. Similarly, Sachs (2020) diverges from dependency theory, which focuses on exploitative relationships between wealthy core nations and impoverished periphery nations, often portraying periphery nations as victims with limited agency (Ghosh, 2019). While dependency theory emphasizes economic exploitation, Sachs (2020) highlights the challenges and opportunities globalization presents for different regions. By acknowledging local agency and adaptability, Sachs (2020) avoids framing periphery nations solely as passive recipients of external forces, offering a more optimistic view of how diverse societies have shaped—and been shaped by—globalization over time.

Chronological Sequence of Globalization

Sachs (2020) outlines seven distinct stages of globalization: the Paleolithic Age (marked by human migration across continents), Neolithic Age (agricultural revolution), Equestrian Age (horse domestication enabling mobility), Classical Age (emergence of major civilizations), Ocean Age (maritime exploration), Industrial Age (mechanization), and Digital Age (information technology revolution), each defined by significant technological and institutional changes that have shaped human societies over time. This historical analysis is essential for understanding the implications of globalization on education, particularly as Sachs (2020) demonstrates how knowledge transmission systems evolved (for example, from oral traditions in the Paleolithic Age to formal educational institutions in the Classical Age). His framework highlights the need for contemporary educational systems to adapt to the challenges and opportunities of an interconnected world, fostering innovation in teaching and learning practices.

Critical Pedagogy: Foundations for Analyzing Globalization in Education

Paulo Freire's (1970) concept of conscientization provides a powerful lens for examining Sachs' work on globalization. Freire's (1970) critique of the 'banking' model of education and his advocacy for 'problem-posing education' question how knowledge about globalization is internalized. By applying Freire's ideas to Sachs' historical analysis, we can uncover hidden power dynamics behind the universality of globalization processes. Sachs' (2020) work might be used to foster critical awareness and empower students to engage more actively with global issues.

Eamon Tewell's (2015) work on critical information literacy offers a complementary framework for analyzing Sachs' presentation of globalization. Tewell's emphasis on questioning widely held assumptions about information and its political nature is

particularly relevant when examining historical narratives of global development. By applying Tewell's insights, we can scrutinize how Sachs (2020) contextualizes information about globalization within broader social and political structures.

Decolonial Critiques: Deconstructing Colonial Knowledge Production

Walter Mignolo's (2009) concept of global coloniality provides a useful framework for analyzing Sachs' (2020) historical narrative of globalization. Mignolo's emphasis on the 'decolonial option' and the call to delinking from empire-centric historical narratives challenges us to interrogate global development. By applying Mignolo's insights, we can examine how the book challenges colonial power structures in its depiction of economic and knowledge systems across different times.

Sylvia Tamale's (2020) call for combining decolonial approaches with Afro-feminist analysis offers a complementary perspective for evaluating Sachs' work. Tamale's emphasis on understanding how colonization, globalization, and neoliberalism have operated as mechanisms of othering and exploitation provides a lens through which to examine Sachs' (2020) portrayal of African and other non-Western contexts. This perspective enables us to consider how the book might be reinterpreted to encourage critical dialogue and foster a more inclusive understanding of globalization.

Contextual Variations in Globalization's Impact

One of the central themes in Sachs' work is the recognition that globalization is not a uniform process; rather, it manifests differently across various contexts, as illustrated in chapter 6 by his discussion of how the Ocean Age brought prosperity to European imperial powers while simultaneously resulting in colonization and exploitation for many societies in Africa, Asia, and the Americas. This insight aligns with critical pedagogy's emphasis on contextual awareness and the importance of local knowledge in educational practices (Giroux, 2011), as education should be rooted in the lived experiences of learners rather than imposing standardized approaches across different contexts. By acknowledging that educational approaches must be tailored to fit the unique cultural and social dynamics of different communities, Sachs (2020) offers a foundation for more participatory and inclusive educational practices.

Decolonizing Globalization Narratives in Education

In chapter 3, Sachs highlights the Equestrian Age's impact on nomadic societies, demonstrating how technological advancements in horse domestication led to increased mobility and cultural exchange, as well as the displacement of Indigenous populations. This example illustrates how Sachs' work resonates with decolonial thought by challenging the simplistic narratives of progress that may overlook non-Western perspectives (Robinson, 2002). By advocating for a broader understanding of globalization that includes diverse voices and experiences, Sachs opens up possibilities for rethinking how education can engage with global issues in ways that are equitable and just. In this context, partnerships emerge as vital mechanisms for fostering

collaboration and knowledge exchange. Sachs' insights encourage educational leaders to consider how collaborations could be structured to empower marginalized communities and promote social justice within the framework of globalization.

Critical Pedagogy and the Role of Education

From his historical analysis of knowledge transmission across different ages, the book suggests that education must play a foundational role in equipping individuals with the knowledge and skills necessary to navigate complex global issues, particularly in the Digital Age. This aligns with the principles of critical pedagogy, which advocate for education that empowers students to critically engage with their social realities and become active participants in shaping their communities (Parjanadze, 2009).

The book highlights the responsibility that educational institutions have in fostering a sense of global citizenship among students. By integrating themes of sustainability, social justice, and cultural awareness into curricula, educators can help students understand their roles within a global context. Sachs' emphasis on the interconnectedness of global challenges serves as a call for educational practices that promote critical thinking and collaborative problem-solving.

While Sachs does not critique educational models, his analysis of how institutional structures throughout history have perpetuated power imbalances suggests implications for traditional education systems that reinforce hierarchies and inequalities, lending support for educational approaches that challenge such norms and encouraging students to question dominant narratives. This perspective is relevant in the context of educational partnerships, which can serve as platforms for innovative pedagogical practices that prioritize equity and inclusivity. Sachs' work thus provides a compelling rationale for reimagining educational collaborations as spaces for transformative learning that address academic goals and contribute to broader societal change.

Implications for Educational Practice

The Ages of Globalization can inform educational practices in several key ways. In curriculum design, the seven-age model provides a structure for developing interdisciplinary curricula that connect local historical patterns to global issues. For instance, educators could create units that trace the evolution of local trade practices from early history to their place in modern global supply chains, highlighting continuities and changes. This approach grounds learning in local realities while fostering an understanding of global interconnectedness. Sachs' emphasis on how geographical and cultural contexts shaped societal development throughout the seven ages of globalization aligns with and enhances critical pedagogy principles, advocating for educational approaches that are responsive to the unique cultural and social dynamics of communities while situating them within a global context.

Sachs' emphasis on the interplay between geography, technology, and institutions encourages innovative teaching methods. Utilizing geographic information system (GIS) technology to analyze how local geographical features have influenced historical development and continue to shape current international diplomatic and trade relations, educators can incorporate similar tools to enhance students' understanding of global interconnections elaborated upon in the book. Building on this interdisciplinary approach, educators could design project-based learning experiences that require students to analyze global issues through multiple lenses, such as examining how climate change impacts ecosystems, economies, and policy negotiations, thereby cultivating systems thinking skills essential for addressing contemporary challenges.

Although Sachs does not explicitly discuss educational practices or partnerships, his analysis of how institutions evolve and collaborate to address complex challenges underscores the potential importance of school-university partnerships in advancing Education for Sustainable Development (ESD). By bringing together researchers, students, educators, and community members, these collaborations can serve as effective mechanisms for integrating global perspectives into local educational contexts. For example, universities could collaborate with local schools to develop project-based learning experiences that require students to analyze local issues within Sachs' global historical framework, such as examining how their community's dominant industries fit into broader patterns of global resource distribution and consumption.

The implications of Sachs' historical analysis for educational equity highlight the importance of fostering balanced power dynamics within school-university collaborations, particularly in comparative education contexts where institutions from different regions and with varying resource levels interact. By prioritizing inclusivity and social justice in their initiatives, these partnerships can help address systemic inequalities that often persist in educational settings. This requires a commitment to ongoing dialogue and collaboration among all partners to ensure that diverse perspectives are represented and valued in decision-making processes. These applications of Sachs' work demonstrate how it can inform the content and methods of education, moving beyond broad generalizations to specific, actionable approaches that are locally grounded and globally relevant.

Limitations

While Sachs acknowledges diverse global perspectives, there could be a more in-depth exploration of non-Western epistemologies and their contributions to global development. An example of this is the concept of Ubuntu, an African philosophy that emphasizes interconnectedness and collective well-being, which could offer valuable insights into alternative models of globalization and education (Terblanche & Waghid, 2023). Ubuntu's principles align with Sachs' emphasis on interconnected systems and the need for collective action to address global challenges, informing more holistic approaches to sustainable development. Incorporating Ubuntu and other philosophies,

the book could benefit from a more diverse understanding of global interdependencies and the role of education in fostering an equitable and just future for humanity.

Conclusion

The Ages of Globalization compels educators and policymakers to fundamentally reassess their approaches to teaching and learning by considering how the historical interplay of geography, technology, and institutions continues to shape educational possibilities and constraints in different global contexts. As we confront unprecedented challenges such as climate change, migration, and conflict, Sachs' insights underscore the important role education must play in fostering a more equitable and resilient society. This book serves not only to catalog the trajectory of global development but also provides a robust toolkit for those dedicated to cultivating impactful educational collaborations that can effectively address the complex challenges of our time.

Sachs' work invites comparative education researchers to reimagine education as a powerful catalyst for equity and sustainability by analyzing how different educational systems worldwide can address shared challenges while respecting diverse cultural contexts. It challenges us to envision educational systems that respond to current crises and anticipate those that may arise in the future. In this context, the book provokes comparative education scholars to consider: How can we encourage innovative cross-cultural educational collaborations that embrace diverse epistemological perspectives to empower future generations to contribute to sustainable solutions for a more just and resilient world?

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